GW - 28

REPORTS

YEAR(S):

1999

Phase III
Report of Subsurface Investigation
Phillips 66 Natural Gas Company
Lee Gas Plant

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March 11, 1991

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Phase III
Report of Subsurface Investigation
Phillips 66 Natural Gas Company
Lee Gas Plant

SUBMITTED BY:	DATE:
GCL Project Director	3/11/91
GCL Senior Advisory Committee	3/4/91
GCL Principal-In-Charge	3/7/91

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SECTION 1.0

1.0 Executive Summary

In January 1991, Geoscience Consultants, Ltd. (GCL) continued a subsurface investigation for Phillips 66 Natural Gas Company (Phillips) at the Lee Gas Plant, Buckeye, New Mexico. Two additional monitor wells were installed at the site, and three existing monitor wells were converted to recovery wells. These wells modify an existing monitoring system, installed in 1988 and 1990, and were designed to further delineate the extent of the dissolved-phase hydrocarbon plume.

Rotary drilling techniques were used to install the two new monitor wells. These new wells and four existing monitor wells were sampled by GCL. The samples were submitted to Analytical Technologies, Inc. for analysis for benzene, toluene, ethylbenzene, xylenes (BTEX), and total petroleum hydrocarbons (TPH), using modified EPA Method 8015.

GCL inspected all the monitor wells and recovery well RW-1 for free-phase hydrocarbon in January and February of 1991. Free-phase hydrocarbon was found to be present in recovery well RW-1 and monitor wells MW-6 and MW-4. Water Quality Control Commission (WQCC) standards for benzene were exceeded at monitor wells MW-6, MW-10, MW-12, and MW-13. WQCC standards for toluene, ethylbenzene, and xylenes were exceeded in MW-6.

The free-phase product plume appears to be centered near recovery well RW-1. The dissolved-phase plume forms a northeast–southwest trending, elongate halo around the plume of free-floating product. Phillips is continuing remediation of the dissolved- and free-phase hydrocarbons by pumping ground water/product from recovery RW-1 to the Lee Gas Plant waste-water treatment system. To aid this existing remediation process, Phillips has initiated ground-water recovery operations at MW-7 and MW-8, (water and product is pumped to the waste-water treatment system) and is recovering product from MW-4 (product is pumped to the on-site slop oil tanks).

One additional monitor well is recommended to further delineate the extent of the dissolved-phase hydrocarbon plume. Recommendations also include implementation of monthly water-level and product thickness measurements, and initiation of quarterly ground-water sampling of selected wells. Additional recommendations may be made regarding the free-phase product present at monitor well MW-6 after further information on the product thickness has been obtained.

SECTION 2.0

2.0 Introduction

In April 1988 Geoscience Consultants, Ltd. (GCL) installed and sampled four monitor wells at the Phillips Lee Gas Plant in southeastern New Mexico (GCL, 1988a). Four wells from a previously existing monitoring system were plugged and abandoned using a cement/bentonite slurry. The results of GCL's initial investigation indicated that both free-phase and dissolved-phase hydrocarbons were present in the saturated zone beneath the site. These findings have led to additional investigations and the design and implementation of remedial actions at the site. Listed here is a brief history of subsequent investigative and remediative actions performed at the facility:

- September 1988: A limited soil-vapor survey identified two potential sources of hydrocarbon contamination (both former evaporation ponds, GCL, 1988b).

- January 1990: Jurisdiction of Phillips' Lee Gas Plant was transferred from NMEID to the New Mexico Oil Conservation Division (NMOCD).

- April 1990: GCL installed four monitor wells and one recovery well at the site to define limits of the free-phase plume and to begin recovery of the floating product (GCL, 1990d).

- August 1990: GCL installed four additional monitor wells to further define the lateral extent of dissolved-phase hydrocarbons in the aquifer (GCL, 1990e).

The most recent activities at the plant were performed in January 1991 at the request of the NMOCD. In a letter to Phillips (NMOCD, 1990), the NMOCD approved the revised locations of two additional monitor wells to be installed near the southwest and leading edge of the dissolved-phase plume, and the conversion of three existing monitor wells to recovery wells. In addition, monitor wells MW-9, MW-10, MW-12, as well as the two additional wells, were to be sampled for BTEX and TPH. In February 1991, the NMOCD requested that MW-6 be resampled because free-phase product was discovered in the well during January's sampling event.

SECTION 3.0

3.0 Methodology

Two monitoring wells (MW-13, and -14) were installed in January 1991 at locations approved by the NMOCD to delineate the downgradient edge of dissolved-phase hydrocarbons in the ground water. Monitor well MW-13 is located near the western edge of the dissolved-phase plume (approximately 150 feet west of monitor well MW-10). The purpose of this well was to define the western extent of the plume boundary. Monitor well MW-14 is located approximately 150 feet west of monitor well MW-12, near the southern boundary of the dissolved-phase plume. The purpose of this well was to define the southern (downgradient) edge of the plume. All monitor well locations are shown on plates 1 and 2. Estimated dissolved- and free-phase plume boundaries are shown on plate 2.

Borehole drilling, monitor well installations, and completion procedures were performed in the same manner as those of previous installations (GCL 1990e), with the exception of monitor well MW-14. Prior to installation of the well screen and casing into the borehole, several hairline fractures were identified in the screen. These defects introduced a potential for well collapse had the damaged screen been installed. Therefore, new well screens were obtained to complete the well. However, due to the remote location of the site, it was not possible to quickly locate wire-wound PVC screen at any of the local distributors and .02-inch factory slot screen was substituted.

The new monitor wells were developed with a submersible pump following the same procedures used in previous investigations (GCL 1990e). Monitor wells MW-13 and MW-14 were developed until the parameters of pH, electric conductivity, and temperature were stabilized and until a volume of water equal to that lost during drilling had been recovered.

The lithology of each of the new monitor well borings was logged on standard GCL lithologic forms and are presented in appendix A. The completion diagrams for these wells are included as appendix B.

During the January investigation and during the second week of February, samples were collected from monitor wells MW-9, MW-10, MW-12, MW-13, MW-14, and MW-6. These samples were collected according to the same protocol used in previous investigations, following strict sampling and chain-of-custody procedures (GCL, 1988c). Analytical Technologies, Inc. of Tempe, Arizona, performed the laboratory analyses of these samples. Each well was sampled for TPH, using Modified EPA Method 8015.

Product-thickness and depth-to-water measurements were made both immediately after installation, and two weeks following installation of the monitor wells. Water level measurements were taken while RW-1 was not in operation, as well as when the pump was operating, in an effort to obtain a more accurate understanding of the ground water surface under static and dynamic conditions. Ground-water surface elevations and depth-to-product measurements are presented in table 3-1. The data that were collected while the recovery system was not in operation are also presented on plate 2 and show the water table under static conditions. These data will be revised in the next report to demonstrate the influence of the newly modified recovery system.

The new monitor wells were surveyed by John West Engineering Co. and the locations were charted on the Lee Gas Plant's northing and easting coordinate system.

In addition to the installation of monitor wells MW-13 and MW-14, three existing monitor wells were converted to recovery wells. Submersible pumps were installed in monitor wells MW-7 and MW-8 to supplement the existing recovery system operations. The ground water recovered from each of these wells will be disposed of through the plant's wastewater treatment system (GCL, 1991f). Supplementing the recovery system further, a product recovery pump (designed to pump only product) was installed in monitor well MW-4. Free-phase product recovered from this well will be pumped to the on-site slop oil tanks.

Table 3-1

Well and Water Surface Elevation Data, January 22, 1991

Location	Casing Elevation	Depth to Water	Depth to Product	Water Surface Elevation
MW-1	3979.25	96.60	NF	3882.65
MW-2	3980.50	98.73	NF	3881.77
MW-3	3980.27	98.61	NF	3881.66
MW-4	3980.16	102.29	97.62	3881.61*
MW-5	3979.82	97.08	NF	3882.74
MW-6	3981.79	98.82	98.70	3883.06*
MW-7	3978.45	97.19	NF	3881.26
MW-8	3979.96	98.63	NF	3881.33
MW-9	3980.17	99.04	NF	3881.13
MW-10	3979.66	98.59	NF	3881.07
MW-11	3978.50	97.53	NF	3880.97
MW-12	3978.82	99.02	NF	3880.80
MW-13	3980.52	99.82	NF	3880.70**
MW-14	3982.23	101.40	NF	3880.83**
RW-1	3980.87	99.82	NM	NA

* Water surface elevation corrected for floating product using a specific gravity for the product of approximately 0.8

All data are presented in feet

NF - None found

NM - Product present, but measurements were unobtainable

NA - Not available

** Water level data obtained 2/26/91 prior to development.

SECTION 4.0

4.0 Results

All existing monitor wells and the recovery well at the site were inspected for the presence of free-phase hydrocarbon on January 22, 1991, and again on February 13, 1991. During each of these visits, free-phase hydrocarbon was observed in monitor wells MW-4 and MW-6 and in recovery well RW-1. Product had not accumulated in any of the other monitor wells.

The free-phase hydrocarbon in monitor well MW-4 was measured in January and found to be 5.06 feet thick. Product thickness could not be measured in February, because the product pump that was installed in January blocked passage of the product measuring probe.

The product thickness in monitor well MW-6 was found to be 0.15 feet during January. At this time, an attempt to obtain a sample of this product was aborted because there was not an adequate volume of product that could be collected without diluting the sample with ground water.

Inspection of recovery well RW-1 revealed that product was floating on the ground water in the vicinity of that well during January and February. Product thickness measurements at RW-1 were not quantifiable because recovery operations were removing the product during pumping and because of differential accumulation rates during recovery.

Analytical results for ground-water samples collected in January and February are presented in table 4-1. The laboratory reports are included as appendix C. Total petroleum hydrocarbon (TPH) constituents were found to be less than 5 mg/l at all of the wells sampled by GCL except MW-6, which yielded results of 170 mg/l.

The Water Quality Control Commission (WQCC) standard for benzene is 10 micrograms per liter (μg/l). The concentration of benzene exceeded WQCC standards in ground-water samples collected in January and February at wells MW-6, MW-10, MW-12, and MW-13; the concentrations found were 72,000 μg/l, 980 μg/l, 120 μg/l, and 16 μg/l, respectively. The WQCC standard for ethylbenzene is 750 μg/l and the WQCC standard for toluene is also 750 μg/l. The WQCC standards for ethylbenzene and toluene were exceeded at MW-6. The concentration of ethylbenzene and toluene found in the sample from MW-6 was 3,000 μg/l and 35,000 μg/l, respectively. The WQCC standard for total xylenes is 620 μg/l. The WQCC standard for total xylenes was also exceeded at MW-6; the concentration of total xylenes at MW-6 was 4,200 μg/l. The concentrations of BTEX and TPH constituents are shown on plate 1 and in table 4-1.

Table 4-1

Analytical Results from January/February 1991 Sampling Event

Analyte	**MW-9**	**MW-10**	**MW-12**	**MW-13**	**WQCC Standard**
Benzene	6.5	980	120	16	10
Ethylbenzene	0.8	15	0.6	3.0	750
Toluene	4.7	16	3.8	19	750
Total xylenes	1.6	<5.0	0.6	5.1	620
TPH	<5 mg/l	<5 mg/l	<5 mg/l	<5 mg/l	NA

Units for analysis are micrograms per liter (μg/l) unless otherwise stated.

ND - Not detected

TPH - Total petroleum hydrocarbons

NA - Not applicable

Table 4-1 (cont'd)

Analytical Results from January/February 1991 Sampling Event

Analyte	**MW-14**	**MW-6**	**WQCC Standard**
Benzene	<0.5	72000	10
Ethylbenzene	<0.5	3000	750
Toluene	<0.5	35000	750
Total xylenes	<0.5	4200	620
TPH	<5 mg/l	170 mg/l	NA

Units for analysis are micrograms per liter (µg/l) unless otherwise stated.

ND - Not detected

TPH - Total petroleum hydrocarbons

NA - Not applicable

RW-1 is pumping a mixture of ground water, dissolved- and free-phase hydrocarbons at an approximate rate of 3.0 gallons per minute into the oil/water separator. The total volume pumped from RW-1, as of February 26, 1991, is 1,296,393 gallons. The recovery pumps in wells MW-7 and MW-8 are now in operation and are also pumping ground water and dissolved-phase hydrocarbons into the oil/water separator at rates of approximately 2 to 3 gallons per minute on an intermittent basis. As of February 26, 1991, the submersible pumps in MW-7 and MW-8 have produced a total of 2,534 gallons and 31,010 gallons, respectively, since February 11, when verbal permission to begin pumping was granted by the New Mexico State Engineer's office in Roswell. The free-phase product pump in monitor well MW-4 has produced a total of 97 gallons of product.

5.0 Conclusions

The lateral extent of free-phase hydrocarbons that are floating on ground water beneath the site has been defined in the area beneath and around the south evaporation pond (plate 2). A small amount of free-phase hydrocarbon has also been identified in one monitor well (MW-6) south of the northern evaporation pond. At the present time, the only wells in which the free-phase product has been found are MW-4, MW-6, and RW-1. However, in 1988, the original, aborted borehole for MW-1 contained observable free-phase product. This aborted borehole was located approximately 15 to 20 feet south-southeast of MW-5 (plates 1 and 2). The current free-phase plume boundaries were estimated using product thickness measurements taken during and approximately 2 weeks after the January work was performed at the site.

The results of the ground-water sampling program indicate that dissolved- and free-phase hydrocarbons occur beneath the site. The free-phase product is centered around RW-1 and the dissolved product forms a northeast-southwest trending, elongate halo around the free-phase plume. Dissolved hydrocarbons were identified in the ground water at all of the monitor wells at the site that were sampled. Of the wells sampled, hydrocarbon concentrations that exceeded WQCC action levels were found at monitor wells MW-6, MW-10, MW-12, and MW-13. All these wells, with the exception of MW-6, are directly downgradient or crossgradient from the free-phase plume that is located beneath the southern evaporation pond. MW-6 is downgradient of the northern evaporation pond. It is uncertain at this time if the northern evaporation pond is the source of the hydrocarbon at monitor well MW-6.

Analytical results from ground-water samples collected at monitor wells MW-9, MW-10, MW-11, and MW-12 (installed in August 1990) and wells MW-13 and MW-14 (installed in January 1991) have further delineated the lateral extent of the dissolved-phase hydrocarbon plume present beneath the site (plate 2). Further work will be required to determine the exact location of the free-phase plume boundary near the northern evaporation pond (plate 2).

SECTION 5.0

SECTION 6.0

6.0 Recommendations

Additional investigation is required to delineate the extent of dissolved-phase hydrocarbons at the Phillips Lee Plant. The following tasks are recommended to complete the investigation:

- Continue recovery operations at RW-1, MW-7, MW-8, and MW-4.
- Measure the depth to ground water and the product thickness in all monitor wells monthly, until remediation is completed, or until a subsequent plan is implemented.
- Initiate quarterly sampling of selected monitor wells for BTEX and TPH. The wells that will be sampled as part of the proposed monitoring plan will be MW-11, MW-12, MW-13, and MW-14, to define the leading edge of the plume.
- Submit quarterly reports to NMOCD presenting the results of the quarterly sampling program. If BTEX constituent concentrations are not acceptable by WQCC standards, GCL recommends the installation of two ground-water monitor wells to locate the leading edge of the dissolved-phase plume. One, MW-15, would be located 150 feet south and 100 feet east of monitor well MW-13. The other well, MW-16, would be located 100 feet south and 100 feet west of monitor well MW-13.
- Reevaluate the sampling program after one year of quarterly sampling of the monitoring system. If recovery system efficiency is satisfactory, then semi-annual sampling should be implemented after NMOCD approval and authorization.
- Prepare recovery system modifications if monthly water-level and product thickness measurements and quarterly ground-water sampling show that the current recovery system is not containing and recovering the plume.

The product found in MW-6 may require additional investigation. It is recommended that MW-6 be monitored for changes in free-phase product thickness. Recommendations for further action will be made in the first quarterly report.

SECTION 7.0

7.0 References

Geoscience Consultants, Ltd., For Phillips Petroleum Company, 1988a, "Report On The Installation Of A Ground Water Monitoring System at Phillips 66 Natural Gas Company."

Geoscience Consultants, Ltd., For Phillips Petroleum Company, 1988b, "Draft Limited Soil Vapor Survey, Phillips Lee Gas Plant."

Geoscience Consultants, Ltd., For Phillips Petroleum Company, 1988c, "Sampling and Analyses Plan for Phillips 66 Natural Gas Company Artesia, Eunice, Lee and Lusk Gasoline Plants."

Geoscience Consultants, Ltd., For Phillips Petroleum Company, 1990d, "Report of Subsurface Investigation Phillips 66 Natural Gas Company Lee Gas Plant."

Geoscience Consultants, Ltd., For Phillips Petroleum Company, 1990e, "Phase II Report of Subsurface Investigation Phillips 66 Natural Gas Company Lee Gas Plant."

Geoscience Consultants, Ltd., For Phillips Petroleum Company, 1991f, "Amendment to Discharge Plan GW-2, Phillips Lee Gas Plant February 12, 1991."

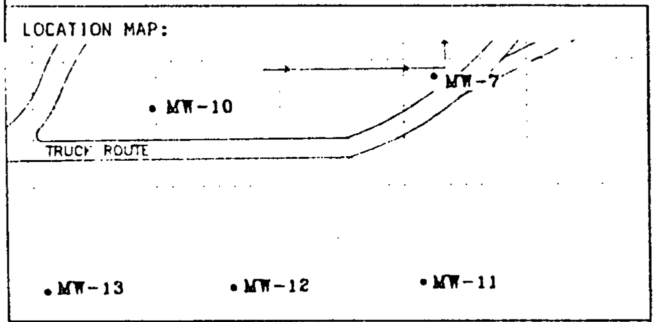
New Mexico Oil Conservation Division, To Phillips Petroleum Company, 1990, RE: Report of Subsurface Investigation Phillips 66 Natural Gas Company Lee Gas Plant Buckeye, New Mexico.

APPENDIX A

Appendix A

Lithologic Logs

LITHOLOGIC LOG



___1/4 ___1/4 SW 1/4 SE 1/4 S 30 T 17 R 35

SITE ID: Phillips Lee LOCATION ID: MW-13
SITE COORDINATES (ft.):
N S 2 + 82.62 E E 6 + 10.33
GROUND ELEVATION (ft. MSL):
STATE: NM COUNTY: Lea
DRILLING METHOD: Water Rotary
DRILLING CONTR.: Larry Felkins
DATE STARTED: 1/22/91 DATE COMPLETED: 1/25/91
FIELD REP.: K. Summers
COMMENTS:

LOCATION DESCRIPTION:

Depth	Visual %	Lith	Drilling Time Scale:	Sample Type and Interval	Lithologic Description
				0-2	Clay/caliche, clay is grysh brn 5YR 3/2 to dk ylsh brn 10YR 4/2. Cche is dk ylsh orange 10YR 6/6. 60% clay, 30% cche, 10% silt to fn sand. Sands are mod well sorted, sbang to sbrndd and uncons.
5				2	Caliche, mod ylsh brn 10YR 5/4 to grysh orange 10YR 7/4. Cuttings are clay size to v crs sand sized. 80% cche, 20% silts to fn sands. Sands are sbrndd to ang and well sorted. Cche is well consol.
10				5	Caliche, mod orange pink 5YR 8/4. Cuttings are silt to crs sand sized. 70% cche, 10% v fn to fn sands, 20% silt. Majority of silt is concentrated in thin beds. Sands are same as above. Cche is well consol.
15				10	Caliche, same as above.
				15	Caliche, grysh orange 10YR 7/4. Cuttings are silt to v crs sand size and highly ang. 70% cche, 30% silt to fn sands. Sands are rndd to sbang, well sorted, semi consol.
20				20	Caliche, same as above.
25				23	Caliche/sandstone, grysh orange pink 5YR 7/2. Cuttings are silt to med pebble gravel sized. 60% sandstone consisting of v fn to fn, rndd to sbang, well sorted, well consol sands w/calcite matrix. 40% cche.
30				31	Caliche/sandstone, same as above.
35				35	Caliche/sandstone, thin sands near 40' which are not as well consolidated, otherwise, same as above.
40				40	Caliche/sandstone, grysh orange pink 5YR 7/2. V fn to fn sands altg w/sandstones of same texture. Well sorted sands 90%, cche 10%. Sands range from well consol to uncons thin layers, are mod well consol, and well sorted.
45				45	Same as above.
50				50	Same as above, w/very hard 6" bed at 53'.

LITHOLOGIC LOG

(Continued)

Location ID MW-13

Depth	Visual %	Lith	Drilling Time Scale:	Sample Type and Interval	Lithologic Description
50					
55				55	Sands/sandstone, same as above w/sands in unconsolidated form dominating.
60				60	Sands/sandstone, same as above.
				62	Sand, light brn 5YR 6/4. V fine to fine sands. 90% sands well rndd to sbrndd, uncons and well sorted. Silt 10%.
65				65	Same as above.
70				70	Sand/sandstone, lt brn 5YR 6/4 to mod ylsh brn. Cutting size is from v fn sand to v crs sand sized. 90% sand/ sandstone, 10% cche. Sands are v fn to fn, rounded to sbrndd, uncons to well consol, well sorted.
75				75	Sand/sandstone, same as above but no cche and less consolidation.
80				80	Sand, mod ylsh brn 10YR 5/4. Sands are v fine to fine, well sorted, unconsolidated, rndd to sbang. 80% v fine, 10% fine, 10% silt.
85				85	Sand, same as above - some thin mod cons layers ≈6" thick.
90				90	Sand, same as above.
95				95	Sandstone, mod ylsh brn 10YR 5/4. Sands are v fine to fine, well sorted mod to well consolidated, rndd to sbang.
				96	Sand, mod ylsh brn 10YR 5/4. 90% v fn to fn sands, 10% silt. Sands are well sorted, uncons, rndd to sbang.
100				100	Sand, mod ylsh brn 10YR 5/4. Sands are slightly darker at depth. V fn to fn sands, well sorted, uncons, rndd to sbang.
105				104	Sand/sandstones, mod ylsh brn 10YR 5/4. Same as above with inter-bedded layers of consol sands of the same description.
110				110	Sand/sandstones, same as above.
115				115	Sand/sandstones, same as above.

LITHOLOGIC LOG

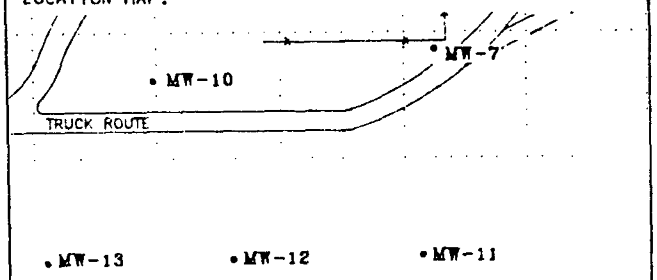
(Continued)

Location ID MW-13

Depth	Visual %	Lith	Drilling Time Scale:	Sample Type and Interval	Lithologic Description
115					
120				119	TD
125					
130					
135					
140					
145					
150					
155					
160					
165					
170					
175					
180					

LITHOLOGIC LOG

LOCATION MAP:



___1/4 ___1/4 SW 1/4 SE 1/4 S 30 T 17 R 35

SITE ID: Phillips Lee LOCATION ID: MW-14
SITE COORDINATES (ft.):
N S 1 + 62.57 E E 5 + 43.62
GROUND ELEVATION (ft. MSL):
STATE: NM COUNTY: Lea
DRILLING METHOD: Water Rotary
DRILLING CONTR.: Larry Felkins
DATE STARTED: 1/24/91 DATE COMPLETED: 1/25/91
FIELD REP.: K. Summers
COMMENTS:

LOCATION DESCRIPTION:

Depth	Visual %	Lith	Drilling Time Scale:	Sample Type and Interval	Lithologic Description
				0-1.5	Caliche/fill, mod ylsh brn 10YR 5/4. Cuttings are clay size to v small pebble size. 80% cche, 20% clay. Cche is well consol. Clay is uncons.
5				1.5	Clay, grayish brn 5YR 3/2 to dk ylsh brn 10YR 4/2. 80% clay, 20% caliche cobbles.
				4	Caliche, v pale orange 10YR 8/2 to grysh orange 10YR 7/4. Cuttings are clay size to v crs sand size. 10% clay, 90% cche. Cche is well consol.
10					
				10	Caliche, same as above, but caliche 90%, silts to fine sands 10%. Sands are sbang, mod sorted, and included in the caliche.
15					
				15	Caliche, same as above.
				18	Sand, grayish orange pink 5YR 7/2. V fine to fine sands, well sorted. 80% v fine sands, 20% fine sands. Sands are rounded to sbang and uncons.
20					
				20	Sand, same as above.
25				25	Sand, same as above
				29	Sandstone, grayish orange pink 5YR 7/2. Calcite cemented, v fine to fine grained, well sorted, rounded to sbrndd, mod well consol.
30					
35				35	Sandstone, same as above.
				37	Sand, pale ylsh brn 10YR 6/2 to mod ylsh brn 10YR 5/4. 90% v fine to fine sands, 10% silt. Sands are well sorted, uncons, and rndd to sbang.
40				40	Sand, same as above.
45					
				45	Sand, same as above.
50					

LITHOLOGIC LOG

(Continued)

Location ID MW-14

Depth	Visual %	Lith	Drilling Time Scale:	Sample Type and Interval	Lithologic Description
50				50	Sand, same as above.
55				55	Sand, same as above.
60				60	Silty sand, mod ylsh brn 10YR 5/4. Same as above w/exception of color change.
65				65	Silty sand, same as above.
70				70	Sand, same as above, but silt <10%.
				74	Sandstone, lt brn 5YR 6/4 to mod ylsh brn 10YR 5/4. Cutting size from v fn sand to v crs sand. Sands are well consol, rndd to sbang and well sorted. 70% v fn sands, 30% fn sands.
75				75	Sand/sandstone, same as above w/thin interbedded loose sands.
80				80	Sand, mod ylsh brn 10YR 5/4. V fine sands, uncons, well sorted, rndd to sbang. 70% v fn sands, 30% fn sands.
85				85	Sand, same as above.
90				90	Sand, same as above.
95				100	Sand/sandstone, same as above w/thin beds of loosely to mod consol sandstones. Cuttings range from v fine to v coarse sand size.
100					
105				105	Sand/sandstone, same as above.
110				110	Sand/sandstone, same as above.
115				115	Sand/sandstone, same as above.

LITHOLOGIC LOG

(Continued)

Location ID MW-14

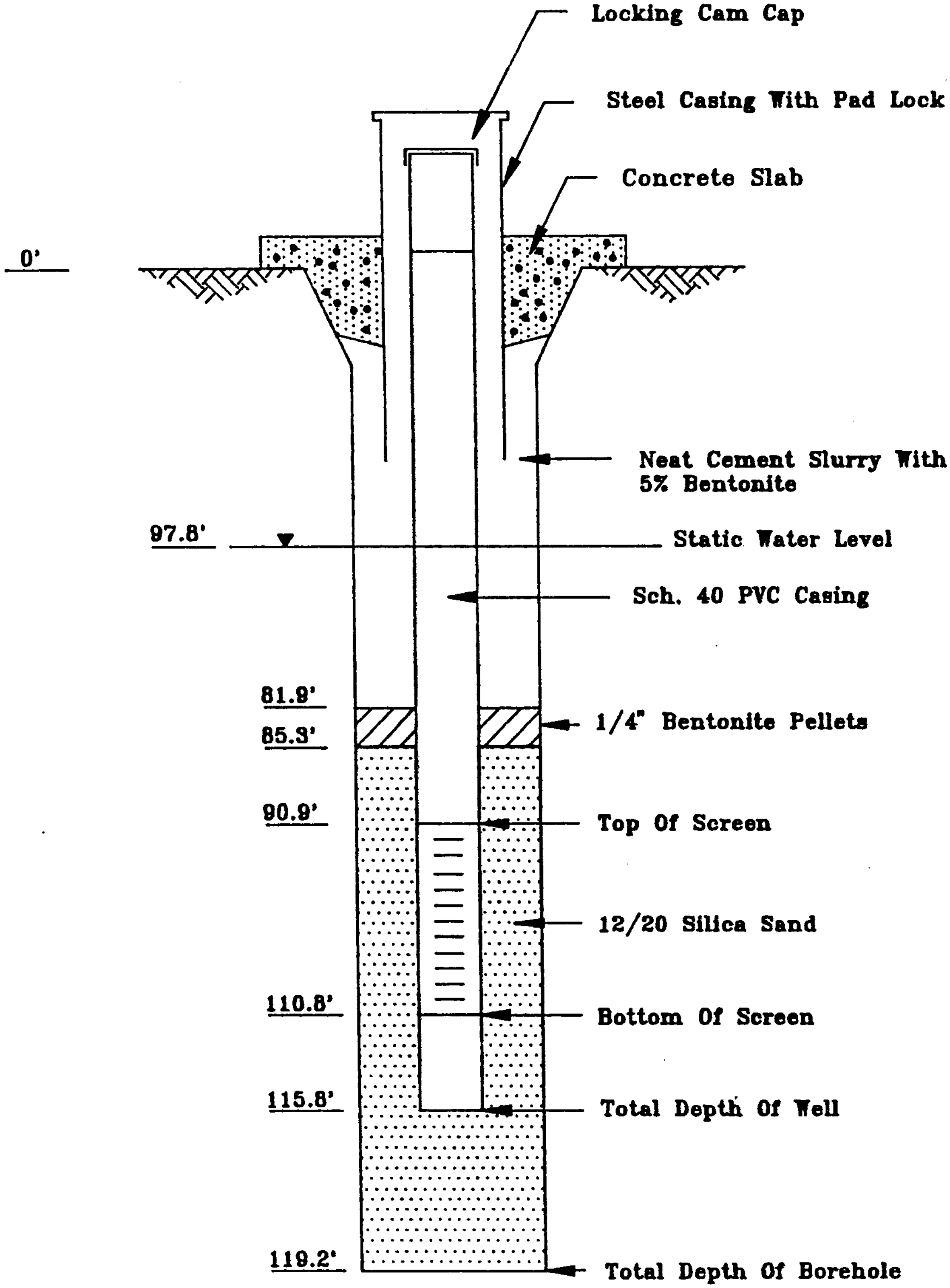
Depth	Visual %	Lith	Drilling Time Scale:	Sample Type and Interval	Lithologic Description
115					
120				119	TD
125					
130					
135					
140					
145					
150					
155					
160					
165					
170					
175					
180					

APPENDIX B

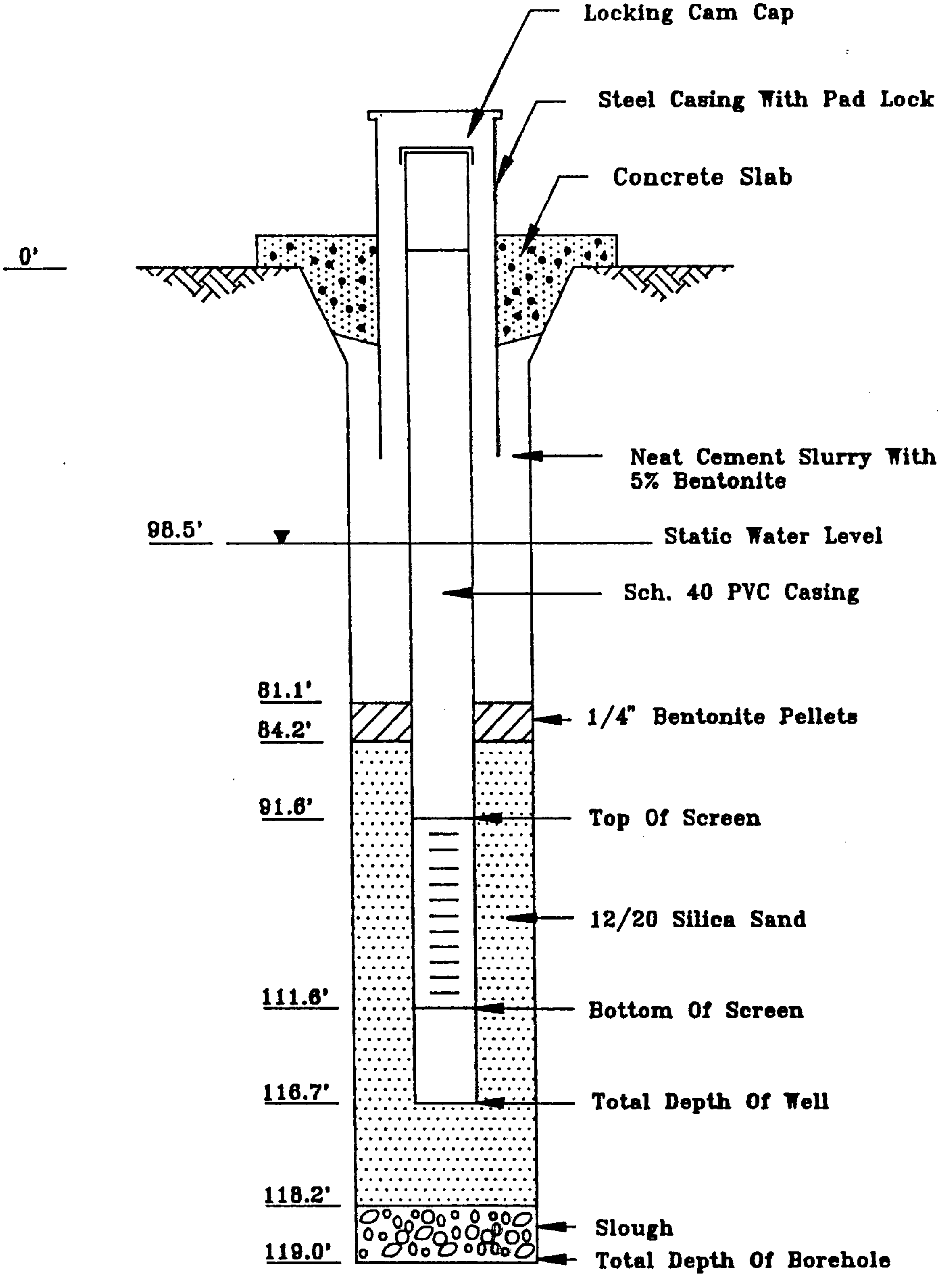
Appendix B

Monitor Well Completion Diagrams

Monitor Well MW-13 Completion Diagram



Monitor Well MW-14 Completion Diagram



APPENDIX C

Appendix C

Laboratory Reports

AnalyticalTechnologies,Inc. 2113 S. 48th Street Suite 107 Tempe, AZ 85282 (602) 438-1530

ATI I.D. 101791

February 1, 1991

Geoscience Consultants, Ltd.
500 Copper, NW
Suite 200
Albuquerque, NM 87102

Project Name/Number: Phillips COC #2644

Attention: Sample Manager

On 01/24/91, Analytical Technologies, Inc. received a request to analyze aqueous sample(s). The sample(s) were analyzed with EPA methodology or equivalent methods. The results of these analyses and the quality control data, which follow each set of analyses, are enclosed.

Using Method 8015 Modified, Client ID 9101231040 MW12 had approx. 3.5 mg/l hydrocarbons quantitated as kerosene (C8-C16); heavier hydrocarbons were also present (C20-C32). Client ID 9101231420 MW10 had approx. 4.4 mg/l hydrocarbons quantitated as gasoline; however, the pattern is unusual. There are peaks at C5-C8 that match a gasoline pattern and peaks at C8-C16 which appear to match closer to a kerosene pattern. In addition, there were heavier hydrocarbons at C20-C32, which could not be quantitated.

If you have any questions or comments, please do not hesitate to contact us at (602)438-1530.

Jane Humphress Foote
Jane Humphress Foote
Project Manager

Robert V. Woods
Robert V. Woods
Laboratory Manager

RVW:clf
Enclosure

AnalyticalTechnologies, Inc.

CLIENT : GEOSCIENCE CONSULTANTS
PROJECT # : C.O.C. 2644
PROJECT NAME : PHILLIPS

DATE RECEIVED : 01/24/91
REPORT DATE : 01/31/91

ATI I.D. : 101791

ATI #	CLIENT DESCRIPTION	MATRIX	DATE COLLECTED
01	9101231040 MW12	AQUEOUS	01/23/91
02	9101231300 MW9	AQUEOUS	01/23/91
03	9101231420 MW10	AQUEOUS	01/23/91
04	TRIP BLANK	AQUEOUS	01/23/91

----- TOTALS -----

MATRIX	# SAMPLES
AQUEOUS	4

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of this report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10179101

TEST : FUEL HYDROCARBONS (MODIFIED EPA METHOD 8015)

CLIENT	: GEOSCIENCE CONSULTANTS	DATE SAMPLED	: 01/23/91
PROJECT #	: C.O.C. 2644	DATE RECEIVED	: 01/24/91
PROJECT NAME	: PHILLIPS	DATE EXTRACTED	: 01/25/91
CLIENT I.D.	: 9101231040 MW12	DATE ANALYZED	: 01/27/91
SAMPLE MATRIX	: AQUEOUS	UNITS	: MG/L
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	-
HYDROCARBONS QUANTITATED USING	-

SURROGATE PERCENT RECOVERIES

DI-N-OCTYL-PHTHALATE (%)	107

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10179102

TEST : FUEL HYDROCARBONS (MODIFIED EPA METHOD 8015)

CLIENT	: GEOSCIENCE CONSULTANTS	DATE SAMPLED	: 01/23/91
PROJECT #	: C.O.C. 2644	DATE RECEIVED	: 01/24/91
PROJECT NAME	: PHILLIPS	DATE EXTRACTED	: 01/25/91
CLIENT I.D.	: 9101231300 MW9	DATE ANALYZED	: 01/27/91
SAMPLE MATRIX	: AQUEOUS	UNITS	: MG/L
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	-
HYDROCARBONS QUANTITATED USING	-
SURROGATE PERCENT RECOVERIES	
DI-N-OCTYL-PHTHALATE (%)	94

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10179103

TEST : FUEL HYDROCARBONS (MODIFIED EPA METHOD 8015)

CLIENT	: GEOSCIENCE CONSULTANTS	DATE SAMPLED	: 01/23/91
PROJECT #	: C.O.C. 2644	DATE RECEIVED	: 01/24/91
PROJECT NAME	: PHILLIPS	DATE EXTRACTED	: 01/25/91
CLIENT I.D.	: 9101231420 MW10	DATE ANALYZED	: 01/27/91
SAMPLE MATRIX	: AQUEOUS	UNITS	: MG/L
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	-
HYDROCARBONS QUANTITATED USING	-
SURROGATE PERCENT RECOVERIES	
DI-N-OCTYL-PHTHALATE (%)	98

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

REAGENT BLANK

TEST : FUEL HYDROCARBONS (MODIFIED EPA METHOD 8015)

		ATI I.D.	: 101791
CLIENT	: GEOSCIENCE CONSULTANTS	DATE EXTRACTED	: 01/25/91
PROJECT #	: C.O.C. 2644	DATE ANALYZED	: 01/27/91
PROJECT NAME	: PHILLIPS	UNITS	: MG/L
CLIENT I.D.	: REAGENT BLANK	DILUTION FACTOR	: N/A

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	-
HYDROCARBONS QUANTITATED USING	-

SURROGATE PERCENT RECOVERIES

DI-N-OCTYL-PHTHALATE (%)	101

AnalyticalTechnologies, Inc.

QUALITY CONTROL DATA

ATI I.D. : 101791

TEST : FUEL HYDROCARBONS (MODIFIED EPA METHOD 8015)

CLIENT : GEOSCIENCE CONSULTANTS
PROJECT # : C.O.C. 2644
PROJECT NAME : PHILLIPS
REF I.D. : 10199936

DATE ANALYZED : 01/27/91
SAMPLE MATRIX : AQUEOUS
UNITS : MG/L

COMPOUNDS	SAMPLE RESULT	CONC. SPIKED	SPIKED SAMPLE	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
FUEL HYDROCARBONS	<5	5.2	6.7	129	6.0	115	11

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Spiked Sample Result} - \text{Duplicate Spike Sample Result})}{\text{Average of Spiked Sample}} \times 100$$

AnalyticalTechnologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10179101

TEST : BTEX (8020)

CLIENT	: GEOSCIENCE CONSULTANTS	DATE SAMPLED	: 01/23/91
PROJECT #	: C.O.C. 2644	DATE RECEIVED	: 01/24/91
PROJECT NAME	: PHILLIPS	DATE EXTRACTED	: N/A
CLIENT I.D.	: 9101231040 MW12	DATE ANALYZED	: 01/25/91
SAMPLE MATRIX	: AQUEOUS	UNITS	: UG/L
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	120
TOLUENE	3.8
ETHYLBENZENE	0.6
TOTAL XYLENES	0.6

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE (%)	100

AnalyticalTechnologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10179102

TEST : BTEX (8020)

CLIENT	: GEOSCIENCE CONSULTANTS	DATE SAMPLED	: 01/23/91
PROJECT #	: C.O.C. 2644	DATE RECEIVED	: 01/24/91
PROJECT NAME	: PHILLIPS	DATE EXTRACTED	: N/A
CLIENT I.D.	: 9101231300 MW9	DATE ANALYZED	: 01/26/91
SAMPLE MATRIX	: AQUEOUS	UNITS	: UG/L
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	6.5
TOLUENE	4.7
ETHYLBENZENE	0.8
TOTAL XYLENES	1.6

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE (%)	97

AnalyticalTechnologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10179103

TEST : BTEX (8020)

CLIENT	: GEOSCIENCE CONSULTANTS	DATE SAMPLED	: 01/23/91
PROJECT #	: C.O.C. 2644	DATE RECEIVED	: 01/24/91
PROJECT NAME	: PHILLIPS	DATE EXTRACTED	: N/A
CLIENT I.D.	: 9101231420 MW10	DATE ANALYZED	: 01/26/91
SAMPLE MATRIX	: AQUEOUS	UNITS	: UG/L
		DILUTION FACTOR	: 10

COMPOUNDS	RESULTS
BENZENE	980
TOLUENE	16
ETHYLBENZENE	15
TOTAL XYLENES	<5.0

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE (%)	105

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10179104

TEST : BTEX (8020)

CLIENT	: GEOSCIENCE CONSULTANTS	DATE SAMPLED	: 01/23/91
PROJECT #	: C.O.C. 2644	DATE RECEIVED	: 01/24/91
PROJECT NAME	: PHILLIPS	DATE EXTRACTED	: N/A
CLIENT I.D.	: TRIP BLANK	DATE ANALYZED	: 01/25/91
SAMPLE MATRIX	: AQUEOUS	UNITS	: UG/L
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	<0.5
TOLUENE	<0.5
ETHYLBENZENE	<0.5
TOTAL XYLENES	<0.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE (%)	109

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

REAGENT BLANK

TEST : BTEX (8020)

		ATI I.D.	: 101791
CLIENT	: GEOSCIENCE CONSULTANTS	DATE EXTRACTED	: 01/25/91
PROJECT #	: C.O.C. 2644	DATE ANALYZED	: 01/25/91
PROJECT NAME	: PHILLIPS	UNITS	: UG/L
CLIENT I.D.	: REAGENT BLANK	DILUTION FACTOR	: N/A

COMPOUNDS	RESULTS
BENZENE	<0.5
TOLUENE	<0.5
ETHYLBENZENE	<0.5
TOTAL XYLENES	<0.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE (%)	97

AnalyticalTechnologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

REAGENT BLANK

TEST : BTEX (8020)

		ATI I.D.	: 101791
CLIENT	: GEOSCIENCE CONSULTANTS	DATE EXTRACTED	: 01/26/91
PROJECT #	: C.O.C. 2644	DATE ANALYZED	: 01/26/91
PROJECT NAME	: PHILLIPS	UNITS	: UG/L
CLIENT I.D.	: REAGENT BLANK	DILUTION FACTOR	: N/A

COMPOUNDS	RESULTS
BENZENE	<0.5
TOLUENE	<0.5
ETHYLBENZENE	<0.5
TOTAL XYLENES	<0.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE (%)	99

Analytical Technologies, Inc.

QUALITY CONTROL DATA

ATI I.D. : 101791

TEST : BTEX (8020)

CLIENT : GEOSCIENCE CONSULTANTS
PROJECT # : C.O.C. 2644
PROJECT NAME : PHILLIPS
REF I.D. : 10180903

DATE ANALYZED : 01/26/91
SAMPLE MATRIX : AQUEOUS
UNITS : UG/L

COMPOUNDS	SAMPLE RESULT	CONC. SPIKED	SPIKED SAMPLE	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
BENZENE	0.8	10	11	102	11	102	0
TOLUENE	<0.5	10	9.6	96	9.9	99	3
ETHYLBENZENE	<0.5	10	8.5	85	8.7	87	2
XYLENES	<0.5	30	25	83	26	87	4

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Spiked Sample Result} - \text{Duplicate Spike Sample Result})}{\text{Average of Spiked Sample}} \times 100$$

Geoscience Consultants, Ltd.

☒ Albuquerque
500 Copper N.W.
Suite 200
Albuquerque, NM 87102
(505) 842-0001

☐ Silver Spring
1109 Spring St.
Suite 706
Silver Spring, MD 20910
(301) 587-2088

☐ Newport Beach
1400 Quail Street
Suite 140
Newport Beach, CA 92660
(714) 724-0536

☐ Las Cruces
P.O. Drawer MM
Las Cruces, NM 88004
(505) 524-5364

No 2644

Chain of Custody

DATE 01/23/91 PAGE 1 OF 1

LAB NAME Analytical Technologies, Inc.
ADDRESS 2113 S. 48th St. Ste. 110
Tempe, AZ 85282
TELEPHONE 602/438-2348

SAMPLERS (SIGNATURE) Dl

ANALYSIS REQUEST

	SAMPLE NUMBER	MATRIX	LOCATION	BASE/NEU/ACID CMPDS. GC/MS/ 625/8270	VOLATILE CMPDS. GC/MS/ 624/8240	PESTICIDES/PCB 608/8080	POLYNUCLEAR AROMATIC 610/8310	PHENOLS, SUB PHENOLS 604/8040	HALOGENATED VOLATILES 601/8010	AROMATIC VOLATILES 602/8020	TOTAL ORGANIC CARBON 415/9060	TOTAL ORGANIC HALIDES 9020	PETROLEUM HYDROCARBONS 418.1	TPH MODIFIED 8015	BTEX	PRIORITY POLLUTANT METALS (13)	CAM METALS (18) TTLC/STLC	EP TOX METALS (8)	SDWA-INORGANICS PRIMARY/SECONDARY	HAZARDOUS WASTE PROFILE				NUMBER OF CONTAINERS
1	9101231040	H2O	MW 12											✓	✓									4
2	9101231300	H2O	MW 9											✓	✓									4
3	9101231420	H2O	MW 10											✓	✓									4
4	TRIP BLANK																							1

PROJECT INFORMATION
PROJECT: PHILLIPS
PROJECT DIRECTOR M. NEE
CHARGE CODE NO.
SHIPPING ID. NO.
VIA:

SAMPLE RECEIPT

TOTAL NO. OF CONTAINERS	13
CHAIN OF CUSTODY SEALS	Y
REC'D GOOD CONDITION/COLD	Y
CONFORMS TO RECORD	Y

LAB NO. 101791

RELINQUISHED BY 1.
DN (Signature) 1600 (Time)
DAVID NEE (Printed Name) 1/23/91 (Date)
GCL (Company)

RELINQUISHED BY 2.
(Signature) (Time)
(Printed Name) (Date)
(Company)

RELINQUISHED BY 3.
(Signature) (Time)
(Printed Name) (Date)
(Company)

RECEIVED BY 1.
(Signature) (Time)
(Printed Name) (Date)
(Company)

RECEIVED BY 2.
(Signature) (Time)
(Printed Name) (Date)
(Company)

RECEIVED BY (LABORATORY) 3.
[illegible] (Signature) 1030 (Time)
[illegible] (Printed Name) 1/24/91 (Date)
(Company)

SPECIAL INSTRUCTIONS/COMMENTS:

DISTRIBUTION: WHITE, CANARY - LABORATORY • PINK - GEOSCIENCE CONSULTANTS, LTD.

RECEIVED FEB 1 1 1991

AnalyticalTechnologies,Inc. 2113 S. 48th Street Suite 107 Tempe, AZ 85282 (602) 438-1530

ATI I.D. 101858

February 6, 1991

Geoscience Consultants, Ltd.
500 Copper, NW
Suite 200
Albuquerque, NM 87102

Project Name/Number: Phillips Lee

Attention: Sample Manager

On 01/29/91, Analytical Technologies, Inc. received a request to analyze aqueous sample(s). The sample(s) were analyzed with EPA methodology or equivalent methods. The results of these analyses and the quality control data, which follow each set of analyses, are enclosed.

If you have any questions or comments, please do not hesitate to contact us at (602)438-1530.

Jane Humphress Foote
Project Manager

Robert V. Woods
Laboratory Manager

RVW:clf
Enclosure

AnalyticalTechnologies, Inc.

CLIENT : GEOSCIENCE CONSULTANTS
PROJECT # : (NONE)
PROJECT NAME : PHILLIPS LEE

DATE RECEIVED : 01/29/91

REPORT DATE : 02/05/91

ATI I.D. : 101858

ATI #	CLIENT DESCRIPTION	MATRIX	DATE COLLECTED
01	9101271330 MW-13	AQUEOUS	01/27/91
02	9101271600 MW-14	AQUEOUS	01/27/91

----- TOTALS -----

MATRIX	# SAMPLES
AQUEOUS	2

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from th date of this report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

AnalyticalTechnologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10185801

TEST : FUEL HYDROCARBONS (MODIFIED EPA METHOD 8015)

CLIENT	: GEOSCIENCE CONSULTANTS	DATE SAMPLED	: 01/27/91
PROJECT #	: (NONE)	DATE RECEIVED	: 01/29/91
PROJECT NAME	: PHILLIPS LEE	DATE EXTRACTED	: 01/29/91
CLIENT I.D.	: 9101271330 MW-13	DATE ANALYZED	: 02/03/91
SAMPLE MATRIX	: AQUEOUS	UNITS	: MG/L
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	-
HYDROCARBONS QUANTITATED USING	-

SURROGATE PERCENT RECOVERIES

DI-N-OCTYL-PHTHALATE (%)	93

AnalyticalTechnologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10185802

TEST : FUEL HYDROCARBONS (MODIFIED EPA METHOD 8015)

CLIENT	: GEOSCIENCE CONSULTANTS	DATE SAMPLED	: 01/27/91
PROJECT #	: (NONE)	DATE RECEIVED	: 01/29/91
PROJECT NAME	: PHILLIPS LEE	DATE EXTRACTED	: 01/29/91
CLIENT I.D.	: 9101271600 MW-14	DATE ANALYZED	: 02/03/91
SAMPLE MATRIX	: AQUEOUS	UNITS	: MG/L
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	-
HYDROCARBONS QUANTITATED USING	-

SURROGATE PERCENT RECOVERIES

DI-N-OCTYL-PHTHALATE (%)	89

AnalyticalTechnologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

REAGENT BLANK

TEST : FUEL HYDROCARBONS (MODIFIED EPA METHOD 8015)

		ATI I.D.	: 101858
CLIENT	: GEOSCIENCE CONSULTANTS	DATE EXTRACTED	: 01/29/91
PROJECT #	: (NONE)	DATE ANALYZED	: 02/03/91
PROJECT NAME	: PHILLIPS LEE	UNITS	: MG/L
CLIENT I.D.	: REAGENT BLANK	DILUTION FACTOR	: N/A

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	-
HYDROCARBONS QUANTITATED USING	-

SURROGATE PERCENT RECOVERIES

DI-N-OCTYL-PHTHALATE (%)	104

AnalyticalTechnologies, Inc.

QUALITY CONTROL DATA

ATI I.D. : 101858

TEST : FUEL HYDROCARBONS (MODIFIED EPA METHOD 8015)

CLIENT : GEOSCIENCE CONSULTANTS
PROJECT # : (NONE)
PROJECT NAME : PHILLIPS LEE
REF I.D. : 10299902

DATE ANALYZED : 02/02/91
SAMPLE MATRIX : AQUEOUS
UNITS : MG/L

COMPOUNDS	SAMPLE RESULT	CONC. SPIKED	SPIKED SAMPLE	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
FUEL HYDROCARBONS	<0.5	4.9	6.1	124	5.3	108	14

$$\% \text{ Recovery} = \frac{\text{(Spike Sample Result - Sample Result)}}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{\text{(Spiked Sample Result - Duplicate Spike Sample Result)}}{\text{Average of Spiked Sample}} \times 100$$

Geoscience Consultants, Ltd.

☒ Albuquerque
500 Copper N.W.
Suite 200
Albuquerque, NM 87102
(505) 842-0001

☐ Silver Spring
1109 Spring St.
Suite 706
Silver Spring, MD 20910
(301) 587-2088

☐ Newport Beach
1400 Quail Street
Suite 140
Newport Beach, CA 92660
(714) 724-0536

☐ Las Cruces
P.O. Drawer MM
Las Cruces, NM 88004
(505) 524-5364

№ 2645

Chain of Custody

DATE 1/28/91 PAGE 1 OF 1

LAB NAME: Analytical Technologies, Inc.
ADDRESS: 2113 S. 48th St. Ste. 110
Tempe, AZ 85282
TELEPHONE: 602/438-2348

SAMPLERS (SIGNATURE): [signature]

ANALYSIS REQUEST

	SAMPLE NUMBER	MATRIX	LOCATION	BASE/NEU/ACID CMPDS. GC/MS/ 625/8270	VOLATILE CMPDS. GC/MS/ 624/8240	PESTICIDES/PCB 608/8080	POLYNUCLEAR AROMATIC 610/8310	PHENOLS, SUB PHENOLS 604/8040	HALOGENATED VOLATILES 601/8010	AROMATIC VOLATILES 602/8020	TOTAL ORGANIC CARBON 415/9060	TOTAL ORGANIC HALIDES 9020	PETROLEUM HYDROCARBONS 418.1	TPH MODIFIED 8015		PRIORITY POLLUTANT METALS (13)	CAM METALS (18) TTLC/STLC	EP TOX METALS (8)	SDWA-INORGANICS PRIMARY/SECONDARY	HAZARDOUS WASTE PROFILE				NUMBER OF CONTAINERS
1	9101271330	H_2O	MW-13											X										3
2	9101271600	H_2O	MW-14											X										3

PROJECT INFORMATION	
PROJECT:	Phillips Lee
PROJECT DIRECTOR:	M. Nee
CHARGE CODE NO.	528-000
SHIPPING ID. NO.	9223390610
VIA:	Fed Ex

SAMPLE RECEIPT	
TOTAL NO. OF CONTAINERS	6
CHAIN OF CUSTODY SEALS	Y
REC'D GOOD CONDITION/COLD	Y
CONFORMS TO RECORD	Y
LAB NO.	101858

	1.	2.	3.
RELINQUISHED BY	[signature] 1100		
(Signature) (Time)	KYLE SUMMERS 1/28		
(Printed Name) (Date)	GCL		
(Company)			
RECEIVED BY			RECEIVED BY (LABORATORY): Linda Eshelman 9:23
(Signature) (Time)			Linda Eshelman 1/29/91
(Printed Name) (Date)			ATI - Tempe
(Company)			

SPECIAL INSTRUCTIONS/COMMENTS:

DISTRIBUTION: WHITE, CANARY - LABORATORY • PINK - GEOSCIENCE CONSULTANTS, LTD.

Analytical**Technologies,**Inc. 2113 S. 48th Street Suite 107 Tempe, AZ 85282 (602) 438-1530

ATI I.D. 102674

February 21, 1991

Geoscience Consultants, Ltd.
500 Copper, NW
Suite 200
Albuquerque, NM 87102

Project Name/Number: Phillips COC 2646

Attention: Sample Manager

On 02/15/91, Analytical Technologies, Inc. received a request to analyze aqueous sample(s). The sample(s) were analyzed with EPA methodology or equivalent methods. The results of these analyses and the quality control data, which follow each set of analyses, are enclosed.

If you have any questions or comments, please do not hesitate to contact us at (602)438-1530.

Jane Humphress Foote

Jane Humphress Foote
Project Manager

Robert V. Woods

Robert V. Woods
Laboratory Manager

RVW:clf
Enclosure

AnalyticalTechnologies, Inc.

CLIENT	: GEOSCIENCE CONSULTANTS	DATE RECEIVED	: 02/15/91
PROJECT #	: C.O.C. 2646		
PROJECT NAME	: PHILLIPS	REPORT DATE	: 02/20/91

ATI I.D. : 102674

ATI #	CLIENT DESCRIPTION	MATRIX	DATE COLLECTED
01	9102131015 MW13	AQUEOUS	02/13/91
02	9102131210 MW14	AQUEOUS	02/13/91

----- TOTALS -----

MATRIX	# SAMPLES
AQUEOUS	2

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of this report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

AnalyticalTechnologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10267401

TEST : BTEX (8020)

CLIENT	: GEOSCIENCE CONSULTANTS	DATE SAMPLED	: 02/13/91
PROJECT #	: C.O.C. 2646	DATE RECEIVED	: 02/15/91
PROJECT NAME	: PHILLIPS	DATE EXTRACTED	: N/A
CLIENT I.D.	: 9102131015 MW13	DATE ANALYZED	: 02/15/91
SAMPLE MATRIX	: AQUEOUS	UNITS	: UG/L
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	16
TOLUENE	19
ETHYLBENZENE	3.0
TOTAL XYLENES	5.1

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE (%)	85

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10267402

TEST : BTEX (8020)

CLIENT	: GEOSCIENCE CONSULTANTS	DATE SAMPLED	: 02/13/91
PROJECT #	: C.O.C. 2646	DATE RECEIVED	: 02/15/91
PROJECT NAME	: PHILLIPS	DATE EXTRACTED	: N/A
CLIENT I.D.	: 9102131210 MW14	DATE ANALYZED	: 02/16/91
SAMPLE MATRIX	: AQUEOUS	UNITS	: UG/L
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	<0.5
TOLUENE	<0.5
ETHYLBENZENE	<0.5
TOTAL XYLENES	<0.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE (%)	83

AnalyticalTechnologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

REAGENT BLANK

TEST : BTEX (8020)

		ATI I.D.	: 102674
CLIENT	: GEOSCIENCE CONSULTANTS	DATE EXTRACTED	: 02/15/91
PROJECT #	: C.O.C. 2646	DATE ANALYZED	: 02/15/91
PROJECT NAME	: PHILLIPS	UNITS	: UG/L
CLIENT I.D.	: REAGENT BLANK	DILUTION FACTOR	: N/A

COMPOUNDS	RESULTS
BENZENE	<0.5
TOLUENE	<0.5
ETHYLBENZENE	<0.5
TOTAL XYLENES	<0.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE (%)	93

Analytical Technologies, Inc.

QUALITY CONTROL DATA

ATI I.D. : 102674

TEST : BTEX (8020)

CLIENT : GEOSCIENCE CONSULTANTS
PROJECT # : C.O.C. 2646
PROJECT NAME : PHILLIPS
REF I.D. : 10268408

DATE ANALYZED : 02/18/91
SAMPLE MATRIX : AQUEOUS
UNITS : UG/L

COMPOUNDS	SAMPLE RESULT	CONC. SPIKED	SPIKED SAMPLE	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
BENZENE	<0.5	10	9.8	98	9.8	98	0
TOLUENE	<0.5	10	10	100	9.8	98	2
ETHYLBENZENE	<0.5	10	9.6	96	9.5	95	1
XYLENES	<0.5	30	28	93	27	90	3

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Spiked Sample Result} - \text{Duplicate Spike Sample Result})}{\text{Average of Spiked Sample}} \times 100$$

Geoscience Consultants, Ltd.

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☐ Las Cruces
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Las Cruces, NM 88004
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№ 2646

Chain of Custody

DATE 02/13/91 PAGE 1 OF 1

LAB NAME Analytical Technologies, Inc.
ADDRESS 2113 S. 48th St. Ste. 110
Tempe, AZ 85282
TELEPHONE 602/438-2348

SAMPLERS (SIGNATURE) D N

ANALYSIS REQUEST

	SAMPLE NUMBER	MATRIX	LOCATION	BASE/NEU/ACID CMPDS. GC/MS/ 625/8270	VOLATILE CMPDS. GC/MS/ 624/8240	PESTICIDES/PCB 608/8080	POLYNUCLEAR AROMATIC 610/8310	PHENOLS, SUB PHENOLS 604/8040	HALOGENATED VOLATILES 601/8010	AROMATIC VOLATILES 602/8020	TOTAL ORGANIC CARBON 415/9060	TOTAL ORGANIC HALIDES 9020	PETROLEUM HYDROCARBONS 418.1	TPH MODIFIED 8015	BTEX	PRIORITY POLLUTANT METALS (13)	CAM METALS (18) TTLC/STLC	EP TOX METALS (8)	SDWA-INORGANICS PRIMARY/SECONDARY	HAZARDOUS WASTE PROFILE				NUMBER OF CONTAINERS
1)	9102131015	H_2O	MW 13												✓									2
2)	9102131210	H_2O	MW 14												✓									1

PROJECT INFORMATION

PROJECT: PHILLIPS
PROJECT DIRECTOR: M. NEE
CHARGE CODE NO. 528-000
SHIPPING ID. NO. 922339063
VIA: Fed-X

SAMPLE RECEIPT

TOTAL NO. OF CONTAINERS	4
CHAIN OF CUSTODY SEALS	Y
REC'D GOOD CONDITION/COLD	Y
CONFORMS TO RECORD	Y

LAB NO. 102674

RELINQUISHED BY 1.	RELINQUISHED BY 2.	RELINQUISHED BY 3.
(Signature) D N (Time) 1300	(Signature) (Time)	(Signature) (Time)
(Printed Name) DAVID NEE (Date) 2/13/91	(Printed Name) (Date)	(Printed Name) (Date)
(Company) GCL	(Company)	(Company)

RECEIVED BY 1.	RECEIVED BY 2.	RECEIVED BY (LABORATORY) 3.
(Signature) (Time)	(Signature) (Time)	(Signature) Marcia Smith (Time) 930am
(Printed Name) (Date)	(Printed Name) (Date)	(Printed Name) Marcia Smith (Date) 2/15/91
(Company)	(Company)	(Company) ATI

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RECEIVED FEB 25 1991

AnalyticalTechnologies, Inc. 2113 S. 48th Street Suite 107 Tempe, AZ 85282 (602) 438-1530

ATI I.D. 102673

February 21, 1991

Geoscience Consultants, Ltd.
500 Copper, NW
Suite 200
Albuquerque, NM 87102

Project Name/Number: Phillips COC 2647

Attention: Sample Manager

On 02/15/91, Analytical Technologies, Inc. received a request to analyze aqueous sample(s). The sample(s) were analyzed with EPA methodology or equivalent methods. The results of these analyses and the quality control data, which follow each set of analyses, are enclosed.

If you have any questions or comments, please do not hesitate to contact us at (602)438-1530.

Jane Humphress Foote
Jane Humphress Foote
Project Manager

Robert V. Woods
Robert V. Woods
Laboratory Manager

RVW:clf
Enclosure

AnalyticalTechnologies, Inc.

CLIENT : GEOSCIENCE CONSULTANTS
PROJECT # : C.O.C 2647
PROJECT NAME : PHILLIPS

DATE RECEIVED : 02/15/91

REPORT DATE : 02/20/91

ATI I.D. : 102673

ATI #	CLIENT DESCRIPTION	MATRIX	DATE COLLECTED
01	9102130830 MW6	AQUEOUS	02/13/91
02	9102131230 DWW	AQUEOUS	02/13/91

----- TOTALS -----

MATRIX	# SAMPLES
AQUEOUS	2

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of this report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

AnalyticalTechnologies, Inc.

GAS CHROMATOGRAPHY - RESULTS.

ATI I.D. : 10267301

TEST : FUEL HYDROCARBONS (MODIFIED EPA METHOD 8015)

CLIENT	: GEOSCIENCE CONSULTANTS	DATE SAMPLED	: 02/13/91
PROJECT #	: C.O.C 2647	DATE RECEIVED	: 02/15/91
PROJECT NAME	: PHILLIPS	DATE EXTRACTED	: 02/15/91
CLIENT I.D.	: 9102130830 MW6	DATE ANALYZED	: 02/17/91
SAMPLE MATRIX	: AQUEOUS	UNITS	: MG/L
		DILUTION FACTOR	: 5

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	170
HYDROCARBON RANGE	C5-C32
HYDROCARBONS QUANTITATED USING	GASOLINE

SURROGATE PERCENT RECOVERIES

DI-N-OCTYL-PHTHALATE (%)	89

AnalyticalTechnologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

REAGENT BLANK

TEST : FUEL HYDROCARBONS (MODIFIED EPA METHOD 8015)

		ATI I.D.	: 102673
CLIENT	: GEOSCIENCE CONSULTANTS	DATE EXTRACTED	: 02/15/91
PROJECT #	: C.O.C 2647	DATE ANALYZED	: 02/16/91
PROJECT NAME	: PHILLIPS	UNITS	: MG/L
CLIENT I.D.	: REAGENT BLANK	DILUTION FACTOR	: N/A

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	-
HYDROCARBONS QUANTITATED USING	-

SURROGATE PERCENT RECOVERIES

DI-N-OCTYL-PHTHALATE (%)	98

AnalyticalTechnologies, Inc.

QUALITY CONTROL DATA

ATI I.D. : 102673

TEST : FUEL HYDROCARBONS (MODIFIED EPA METHOD 8015)

CLIENT : GEOSCIENCE CONSULTANTS
PROJECT # : C.O.C 2647
PROJECT NAME : PHILLIPS
REF I.D. : 10299926

DATE ANALYZED : 02/16/91
SAMPLE MATRIX : AQUEOUS
UNITS : MG/L

COMPOUNDS	SAMPLE RESULT	CONC. SPIKED	SPIKED SAMPLE	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
FUEL HYDROCARBONS	<5	16	21	131	21	131	0

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Spiked Sample Result} - \text{Duplicate Spike Sample Result})}{\text{Average of Spiked Sample}} \times 100$$

AnalyticalTechnologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10267301

TEST : BTEX (8020)

CLIENT	: GEOSCIENCE CONSULTANTS	DATE SAMPLED	: 02/13/91
PROJECT #	: C.O.C 2647	DATE RECEIVED	: 02/15/91
PROJECT NAME	: PHILLIPS	DATE EXTRACTED	: N/A
CLIENT I.D.	: 9102130830 MW6	DATE ANALYZED	: 02/15/91
SAMPLE MATRIX	: AQUEOUS	UNITS	: UG/L
		DILUTION FACTOR	: 1000

COMPOUNDS	RESULTS
BENZENE	72000
TOLUENE	35000
ETHYLBENZENE	3000
TOTAL XYLENES	4200

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE (%)	89

AnalyticalTechnologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

REAGENT BLANK

TEST : BTEX (8020)

		ATI I.D.	: 102673
CLIENT	: GEOSCIENCE CONSULTANTS	DATE EXTRACTED	: 02/15/91
PROJECT #	: C.O.C 2647	DATE ANALYZED	: 02/15/91
PROJECT NAME	: PHILLIPS	UNITS	: UG/L
CLIENT I.D.	: REAGENT BLANK	DILUTION FACTOR	: N/A

COMPOUNDS	RESULTS
BENZENE	<0.5
TOLUENE	<0.5
ETHYLBENZENE	<0.5
TOTAL XYLENES	<0.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE (%)	93

AnalyticalTechnologies, Inc.

QUALITY CONTROL DATA

ATI I.D. : 102673

TEST : BTEX (8020)

CLIENT : GEOSCIENCE CONSULTANTS
PROJECT # : C.O.C 2647
PROJECT NAME : PHILLIPS
REF I.D. : 10268408

DATE ANALYZED : 02/18/91
SAMPLE MATRIX : AQUEOUS
UNITS : UG/L

COMPOUNDS	SAMPLE RESULT	CONC. SPIKED	SPIKED SAMPLE	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
BENZENE	<0.5	10	9.8	98	9.8	98	0
TOLUENE	<0.5	10	10	100	9.8	98	2
ETHYLBENZENE	<0.5	10	9.6	96	9.5	95	1
XYLENES	<0.5	30	28	93	27	90	3

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Spiked Sample Result} - \text{Duplicate Spike Sample Result})}{\text{Average of Spiked Sample}} \times 100$$

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№ 2647

Chain of Custody

DATE 02/13/91 PAGE 1 OF 1

LAB NAME Analytical Technologies, Inc.
ADDRESS 2113 S. 48th St. Ste. 110
Tempe, AZ 85282
TELEPHONE 602/438-2348

SAMPLERS (SIGNATURE)

ANALYSIS REQUEST

	SAMPLE NUMBER	MATRIX	LOCATION	BASE/NEU/ACID CMPDS. GC/MS/ 625/8270	VOLATILE CMPDS. GC/MS/ 624/8240	PESTICIDES/PCB 608/8080	POLYNUCLEAR AROMATIC 610/8310	PHENOLS, SUB PHENOLS 604/8040	HALOGENATED VOLATILES 601/8010	AROMATIC VOLATILES 602/8020	TOTAL ORGANIC CARBON 415/9060	TOTAL ORGANIC HALIDES 9020	PETROLEUM HYDROCARBONS 418.1	TPH & BTEX MODIFIED 8015		PRIORITY POLLUTANT METALS (13)	CAM METALS (18) TTLC/STLC	EP TOX METALS (8)	SDWA-INORGANICS PRIMARY/SECONDARY	HAZARDOUS WASTE PROFILE				NUMBER OF CONTAINERS
1)	9102130830	H2O	MW 6											✓										2
2)	9102131230	H2O	DWW											✓										2

PROJECT INFORMATION	
PROJECT:	PHILLIPS
PROJECT DIRECTOR	M. DEE
CHARGE CODE NO.	528-000
SHIPPING ID NO.	9223390632
VIA:	Fed-X

SAMPLE RECEIPT	
TOTAL NO. OF CONTAINERS	4
CHAIN OF CUSTODY SEALS	Y
REC'D GOOD CONDITION/COLD	Y
CONFORMS TO RECORD	Y
LAB NO.	102673

RELINQUISHED BY 1.	RELINQUISHED BY 2.	RELINQUISHED BY 3.
(Signature) [signature] (Time) 1500	(Signature) (Time)	(Signature) (Time)
(Printed Name) DAVID DEE (Date) 2/15/91	(Printed Name) (Date)	(Printed Name) (Date)
(Company) GCL	(Company)	(Company)

RECEIVED BY 1.	RECEIVED BY 2.	RECEIVED BY (LABORATORY) 3.
(Signature) (Time)	(Signature) (Time)	(Signature) Marcia Smith (Time) 9:30 am
(Printed Name) (Date)	(Printed Name) (Date)	(Printed Name) MARCIA SMITH (Date) 2/15/91
(Company)	(Company)	(Company) ATI

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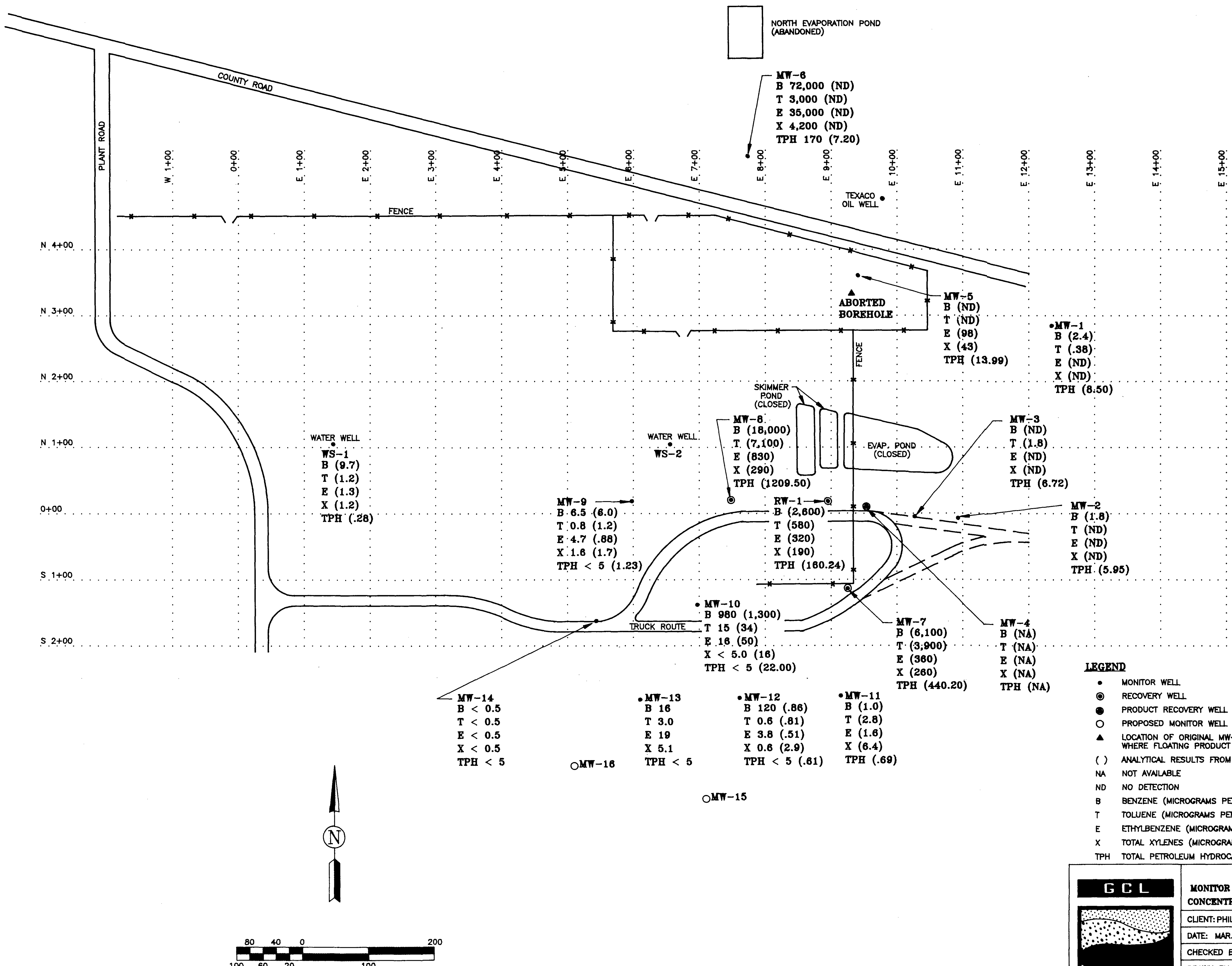


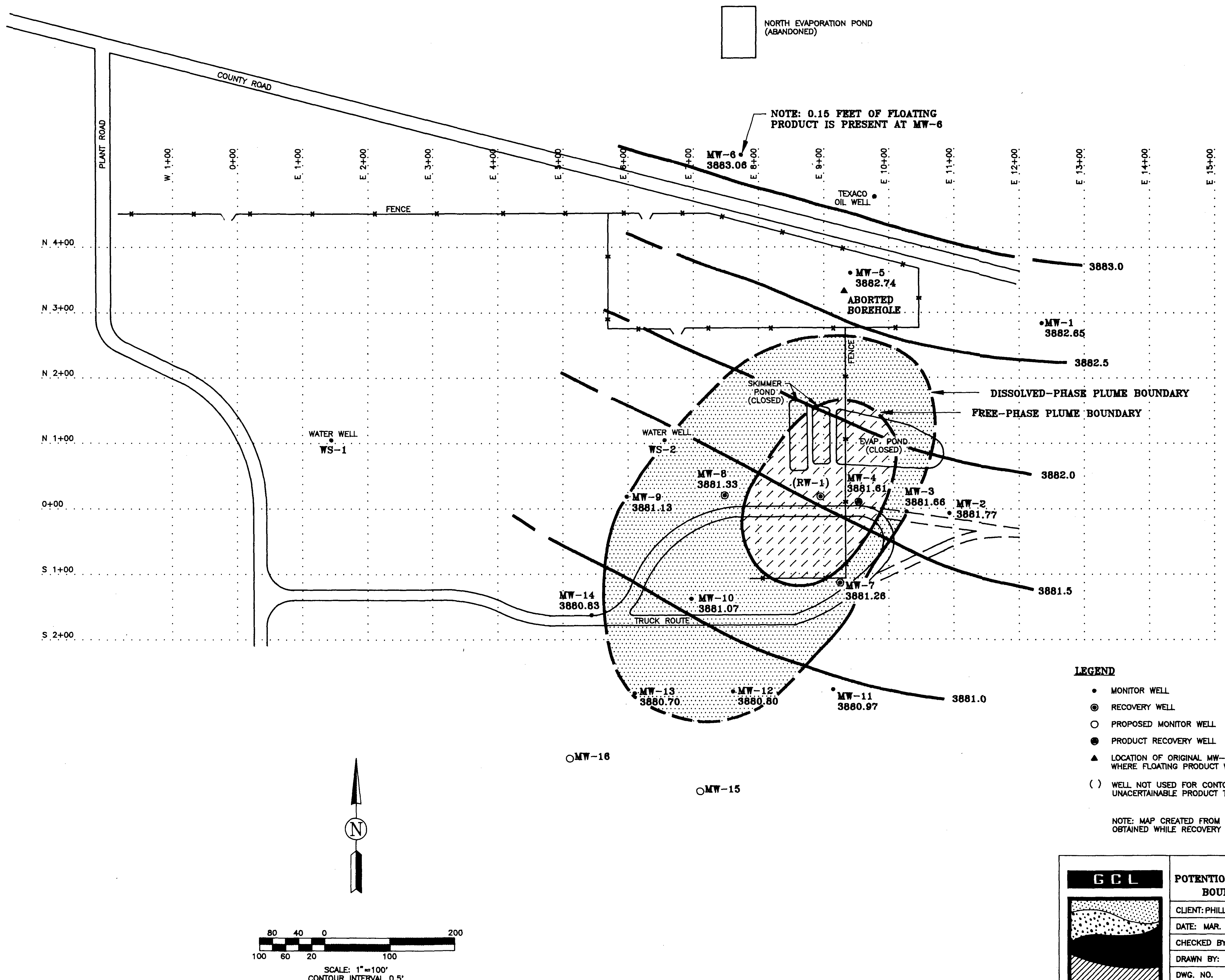
LEGEND

•	MONITOR WELL
◎	RECOVERY WELL
●	PRODUCT RECOVERY WELL
○	PROPOSED MONITOR WELL
▲	LOCATION OF ORIGINAL MW-1 BOREHOLE WHERE FLOATING PRODUCT WAS FOUND
( )	ANALYTICAL RESULTS FROM APRIL AND OCTOBER
NA	NOT AVAILABLE
ND	NO DETECTION
B	BENZENE (MICROGRAMS PER LITER)
T	TOLUENE (MICROGRAMS PER LITER)
E	ETHYLBENZENE (MICROGRAMS PER LITER)
X	TOTAL XYLENES (MICROGRAMS PER LITER)
TPH	TOTAL PETROLEUM HYDROCARBONS (MILLIGRAMS PER LITER)

GCL

PLATE 1
MONITOR WELL LOCATION MAP WITH BTEX AND TPH CONCENTRATIONS FROM JANUARY & FEBRUARY, 1991

CLIENT: PHILLIPS PETROLEUM COMPANY
DATE: MAR. 5, 1991
CHECKED BY: K. SUMMERS
DRAWN BY: J.T.N.
DWG. NO. 439-000



LEGEND

- • MONITOR WELL
- ◉ RECOVERY WELL
- ○ PROPOSED MONITOR WELL
- ● PRODUCT RECOVERY WELL
- ▲ LOCATION OF ORIGINAL MW-1 BOREHOLE WHERE FLOATING PRODUCT WAS FOUND
- ( ) WELL NOT USED FOR CONTOURING DUE TO UNACERTAINABLE PRODUCT THICKNESS

NOTE: MAP CREATED FROM WATER LEVELS WHICH WERE OBTAINED WHILE RECOVERY PUMPS WERE NOT OPERATING.

RECEIVED
MAR 12 1991
OIL CONSERVATION DIV.
SANTA FE

GCL

PLATE 2
POTENTIOMETRIC WATER SURFACE AND PLUME BOUNDARY MAP FOR JANUARY, 1991

CLIENT: PHILLIPS PETROLEUM COMPANY
DATE: MAR. 5, 1991
CHECKED BY: K. SUMMERS
DRAWN BY: J.T.N.
DWG. NO. 439-000

RECEIVED

SEP 09 1991

OIL CONSERVATION DIV.
SANTA FE

File Copy

Phase IV
Report of Subsurface Investigation
Phillips 66 Natural Gas Company
Lee Gas Plant

September 5, 1991

Prepared for:

Mr. Ralph McCord
PHILLIPS PETROLEUM COMPANY
4001 Penbrook
Odessa, Texas

Prepared by:

HYGIENETICS, INC./GEOSCIENCE CONSULTANTS, LTD

SOUTHWEST REGIONAL OFFICE
500 Copper Avenue, NW
Suite 200
Albuquerque, New Mexico 87102
(505) 842-0001
FAX (505) 842-0595

Phase IV
Report of Subsurface Investigation
Phillips 66 Natural Gas Company
Lee Gas Plant

SUBMITTED BY: DATE:

[signature] 9-5-91
GCL Project Director

[signature] 9/5/91
GCL Senior Advisory Committee

[signature] 9-5-91
GCL Principal-In-Charge

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SECTION 1.0

1.0 Executive Summary

On June 26, and 27, 1991, Geoscience Consultants, Ltd. (GCL) continued a subsurface investigation for Phillips 66 Natural Gas Company (Phillips) at the Lee Gas Plant, Buckeye, New Mexico. The subsurface investigation was initiated in 1988 with the closure of four RCRA monitor wells and the installation of four investigatory monitor wells. To date, eleven ground-water monitor wells, four ground-water recovery wells, and one product recovery well have been installed at the Lee Plant.

GCL inspected all the monitor wells and recovery wells for free-phase hydrocarbon in June 1991. Free-phase hydrocarbons were found to be present in recovery well RW-1 and monitor wells MW-6 and MW-4. All of the existing ground-water monitor wells, recovery wells, and two water supply wells that did not contain free-phase hydrocarbons were sampled for petroleum constituents.

Water Quality Control Commission (WQCC) standards for benzene were exceeded at monitor wells MW-3, MW-5, MW-7, MW-8, MW-9, and MW-10, and water-supply well WS-2. The WQCC standard for toluene was exceeded in MW-7 and MW-8.

The free-phase product plume, associated with the southern evaporation pond, appears to be centered near recovery well RW-1. The dissolved-phase plume forms a northeast–southwest trending, elongate halo around the plume of free-floating product. Phillips is continuing the remediation of the dissolved- and free-phase hydrocarbons that was initiated during April, 1990. This interim remedial action consists of pumping ground water and/or product from recovery well RW-1, and pumping ground water from MW-7, MW-8, and MW-10 to the Lee Gas Plant waste-water treatment system. Additionally, Phillips is recovering product from MW-4, that is then pumped to the on-site slop oil tanks.

Free-phase hydrocarbons are present at MW-6 north of the Lee Plant. The source of these hydrocarbons is probably the closed north evaporation pond (inlet receiver pit.)

Phillips will install and sample six additional ground-water monitoring wells. The proposed monitor well locations are placed so that Phillips can characterize the ground-water directly up-gradient and down-gradient of the inlet receiver pit, the ground water that is entering the plant from the north and the ground water that is leaving the plant from the south.

Following evaluation of the analytical results from sampling the ground water from the proposed monitor wells and the wells scheduled for quarterly sampling, Phillips will submit a final remedial strategy plan. This report is scheduled for submission in January of 1992.

SECTION 2.0

2.0 Introduction

Since early 1988 Geoscience Consultants, Ltd. (GCL) has been involved in a subsurface investigation at the Phillips Lee Gas Plant in southeastern New Mexico (GCL, 1988a). The results of GCL's initial investigation indicated that both free-phase and dissolved-phase hydrocarbons were present in the saturated zone beneath the site. Fourteen ground-water monitor wells and one recovery well have been installed at the site. Three of the fourteen monitor wells have been converted to recovery wells. Listed here is a brief history of the investigative and remediative actions performed at the facility:

- April 1988: GCL installed four monitor wells and abandoned four existing monitor wells from a previously existing RCRA monitoring program. (GCL, 1988a)

- September 1988: A limited soil-vapor survey identified two potential sources of hydrocarbon contamination (both former evaporation ponds, GCL, 1988b).

- January 1990: Jurisdiction of Phillips' Lee Gas Plant was transferred from NMEID to the New Mexico Oil Conservation Division.

- April 1990: GCL installed four monitor wells and one recovery well at the site to define limits of the free-phase plume and to begin recovery of the floating product (GCL, 1990a).

- August 1990: GCL installed four additional monitor wells to further define the lateral extent of dissolved-phase hydrocarbons in the aquifer (GCL, 1990b).

- January 1991: GCL installed two additional monitor wells to delineate the leading edge of the dissolved-phase plume. Two existing monitor wells were converted to recovery wells (GCL,1991)

- May 1991: Phillips converted monitor well MW-10 to a recovery well per NMOCDs' April 2, 1991 request (NMOCD, 1991).

In June 1991 GCL conducted a contemporaneous ground-water sampling event. Prior sampling events were limited to collecting samples from just those wells installed in the current phase of work along with selected wells from previous phases to correlate analytical results. The ground-water recovery wells were turned off for a period of approximately two weeks before sampling to allow the aquifer to equilibrate. Two of the recovery wells (RW-

1 and MW-4), and one of the monitor wells (MW-6) were not sampled due to the presence of free-phase hydrocarbons. The June 26, 1991 ground-water sampling fulfills NMOCD's request for

- Quarterly sampling of the ground-water from monitor wells MW-9, MW-11, MW-12, MW-13, MW-14

- Semi-annual sampling of the ground-water from water supply wells WS-1 and WS-2

- The first annual sampling of recovery wells that do not contain free-phase hydrocarbon.

SECTION 3.0

3.0 Methodology

During June, 1991, a comprehensive sampling plan was implemented at the Lee Gas Plant. This implementation included collecting depth to ground-water measurements and ground-water samples from the existing recovery/monitor well network (MW-1 through MW-14) and water supply wells WS-1 and WS-2 at the site, but excluded wells that contain free-phase product (MW-4, MW-6, and RW-1). John West Engineering Company of Hobbs, New Mexico surveyed the top-of-casing elevations at the water supply wells. During the conversion of monitor wells MW-7, MW-8, and MW-10 to recovery wells the casings were modified, so these wells were resurveyed.

All monitor, recovery, and water-supply well locations are shown on plate 1. Recovery operations were halted approximately two weeks before sample collection to allow conditions in the aquifer to stabilize. Depth-to-product and depth-to-water measurements were taken before, during, and after the sampling event.

Samples were obtained from the wells according to standard GCL protocol, following strict chain-of-custody procedures. Four-inch and larger diameter wells were purged using a submersible pump, while two-inch wells were purged using a one-and-six-tenths(1.6)-inch teflon bailer. All samples were collected with dedicated, disposable one-and-six-tenths(1.6)-inch teflon bailers. A new bailer was used at each new location and the one used at the previous location discarded.

GCL shipped the ground-water samples to Analytical Technologies Inc. (ATI) of Phoenix, Arizona for analysis. Benzene, toluene, ethylbenzene, total xylene (BTEX) concentrations were measured using EPA method 602, and total petroleum hydrocarbons (TPH), using EPA method modified 8015.

SECTION 4.0

4.0 Results

Depth to ground-water/product measurements were collected at all of the monitor, recovery and water-supply well locations on June 26, 1991. Where free-phase hydrocarbons were found, the elevation of the potentiometric surface was estimated by multiplying the thickness of the product by it's density (approximately .8 the density of water) and adding this result to the water surface elevation. Water surface elevations, depth to water measurements, and depth to product measurements are presented in table 4-1.

All existing monitor wells and recovery wells at the site were inspected during the June sampling event to determine whether free-phase hydrocarbons were present. Free-phase hydrocarbons were observed in monitor wells MW-4 and MW-6, and in recovery well RW-1. Product had not accumulated in any of the other monitor wells.

Three and one-tenth (3.1) feet of free-phase hydrocarbons were measured in monitor well MW-4. This measurement was obtained after the product pump was removed and the aquifer allowed to equilibrate. The product thickness in monitor well MW-6 was found to be 0.41 feet during June. This represents an increase in thickness of .29 feet compared to .12 feet in January, 1991. Measurement of the product thickness in recovery well RW-1 under static conditions indicated that 3.4 feet of floating product was present in June.

Analytical results for ground-water samples collected in June are presented in table 4-2. The laboratory reports are included in appendix A.

Total petroleum hydrocarbons (TPH) constituents were found in all wells sampled. TPH concentrations ranged from a low of 64 ppb at WS-1 to a high of 31,000 ppb at monitor well MW-5. Due to GCL's request for a lower detection limit for TPH analyses than was previously delivered by ATI, the TPH results represent only the hydrocarbon range of C10–C36. These data are still useful in determining the possible contribution of heavier hydrocarbons common in crude oil. Attached as appendix B is ATI's response to GCL's inquiries about the analyses.

Table 4-1

Well and Water Surface Elevation Data, June 26, 1991

Location	Casing Elevation	Depth to Water Datum is TOC	Depth to Product Datum is TOC	Water Surface Elevation
MW-1	3979.25	97.02	N	3882.23
MW-2	3980.50	99.17	N	3881.33
MW-3	3980.27	99.04	N	3881.23
MW-4	3980.16	101.51	98.38	3881.15*
MW-5	3979.82	97.54	N	3882.28
MW-6	3981.79	99.49	99.08	3882.63*
MW-7	3979.72	98.98	N	3880.74
MW-8	3981.31	100.52	N	3880.79
MW-9	3980.17	99.64	N	3880.53
MW-10	3981.02	100.50	N	3880.52
MW-11	3978.50	98.12	N	3880.38
MW-12	3978.82	98.64	N	3880.18
MW-13	3980.52	100.55	N	3879.97
MW-14	3982.23	102.06	N	3880.17
RW-1	3980.87	102.34	98.94	3881.25*
WS-1	3982.78	103.22	N	3879.56
WS-2	3980.18	99.14	N	3881.04

*Water surface elevation corrected for floating product using a specific gravity for the product of approximately 0.8

All data are presented in feet

N = None found

Table 4-2

Analytical Results from June 1991 Sampling Event

Analyte	MW-1	MW-2	MW-3	MW-5	WQCC Standard
Benzene	<1.5	<1.5	43	5,000	10
Toluene	<1.5	<1.5	5.7	570	750
Ethylbenzene	<1.5	<1.5	1.5	15	750
Total xylenes	<2.5	<2.5	<2.5	88	620
TPH	330	480	750	31,000	NA

Units for analysis are micrograms per liter (µg/l) unless otherwise stated.

TPH - Total petroleum hydrocarbons

NA - Not applicable

Table 4-2 (cont'd)

Analytical Results from June 1991 Sampling Event

Analyte	MW-7	MW-8	MW-9	MW-10	WQCC Standard
Benzene	3,200	21,000	160	9,700	10
Toluene	1,400	1,300	56	420	750
Ethylbenzene	23	12	2.5	84	750
Total xylenes	130	420	4.2	39	620
TPH	660	1,400	780	1,300	NA

Units for analysis are micrograms per liter (μg/l) unless otherwise stated.

TPH - Total petroleum hydrocarbons

NA - Not applicable

Table 4-2 (cont'd)

Analytical Results from June 1991 Sampling Event

Analyte	MW-11	MW-12	MW-13	MW-14	WQCC Standard
Benzene	<1.5	<1.5	1.9	<1.5	10
Toluene	<1.5	1.6	<1.5	<1.5	750
Ethylbenzene	<1.5	<1.5	<1.5	<1.5	750
Total xylenes	<2.5	<2.5	<2.5	<2.5	620
TPH	540	230	360	1,200	NA

Units for analysis are micrograms per liter ($\mu g/l$) unless otherwise stated.

TPH - Total petroleum hydrocarbons

NA - Not applicable

Table 4-2 (cont'd)

Analytical Results from June 1991 Sampling Event

Analyte	WS-1	WS-2	WQCC Standard
Benzene	6.5	280	10
Toluene	<1.5	27	750
Ethylbenzene	<1.5	1.8	750
Total xylenes	<2.5	2.5	620
TPH	64	1,500	NA

Units for analysis are micrograms per liter (μg/l) unless otherwise stated.

TPH - Total petroleum hydrocarbons

NA - Not applicable

The Water Quality Control Commission (WQCC) standard for benzene is 10 micrograms per liter (μg/l or ppb). The WQCC standard for benzene was exceeded in 7 wells;

- MW-3 43 ppb
- MW-5 5,000 ppb
- MW-7 3,200 ppb
- MW-8 21,000 ppb
- MW-9 160 ppb
- MW-10 9,700 ppb
- WS-2 280 ppb

The WQCC standards for ethylbenzene and toluene are 750 ppb. The WQCC standard for ethylbenzene was not exceeded in any of the wells that were sampled. The WQCC standard for toluene, however, was exceeded at monitor wells MW-7 and MW-8. The concentrations of toluene found in these samples were 1,400 ppb and 1,300 ppb, respectively. The WQCC standard for total xylenes is 620 ppb. This value was not exceeded in any of the wells that were sampled. The concentrations of BTEX and TPH for all 1990 and 1991 events are shown on plate 1.

SECTION 5.0

5.0 Conclusions

Water surface elevations were plotted and a potentiometric surface map drawn (plate 2). plate 2 shows that the potentiometric surface, after allowing the aquifer to equilibrate, is consistent with earlier results (GCL,1990b). The direction of flow changes from approximately 5-degrees west-of-south at the eastern edge of the plant to approximately 40-degrees west-of-south at the central part of the plant. The gradient of the potentiometric surface is approximately 1 vertical foot for every 650 horizontal feet (.0015 ft/ft).

The free-phase hydrocarbons that have been identified indicate that the product plumes could likely be associated with three sources, the southern evaporation pond, the north evaporation pond (both of which are closed, plate 3), or the oil field located upgradient from the facility.

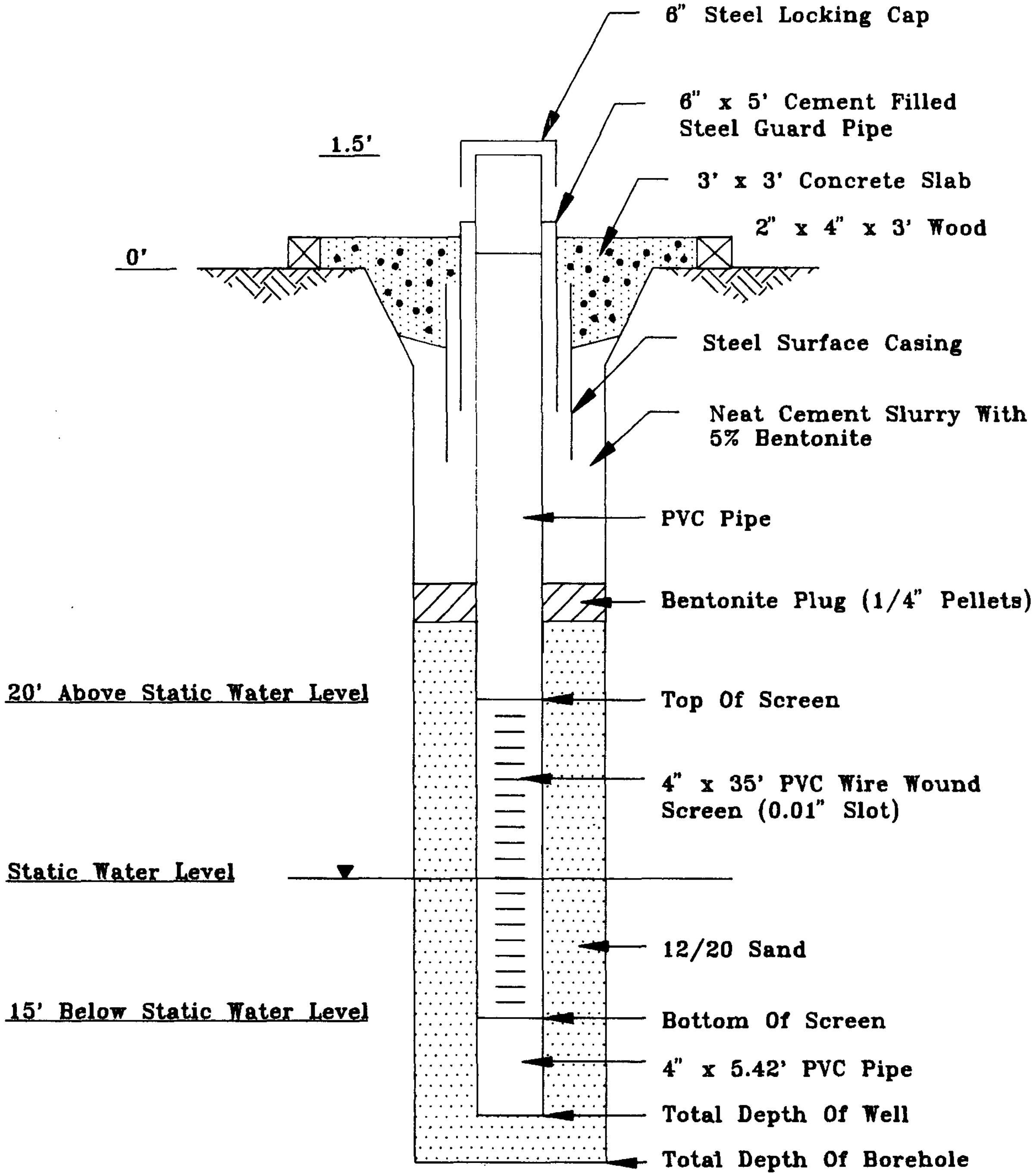
The analytical results for BTEX constituents are consistent with past results. They indicate that there is a dissolved-phase plume that forms a northeast-southwest trending, elongate halo around the free-phase plume. Dissolved hydrocarbons were identified in the ground water at all of the monitor wells on the plant site. Such conditions are typical at sites located in a producing oil field. Hydrocarbon concentrations that exceeded WQCC action levels were found at monitor wells MW-3, MW-5, MW-7, MW-8, MW-9, and MW-10, and water-supply well WS-2. The extent of the dissolved-phase plume is shown on plate 3.

The extent of the dissolved-phase plume associated with the product at MW-6 is not known. Recommendations for investigating ground water in this area are discussed in section 6.0.

SECTION 6.0

Figure 1

Typical Proposed Monitor Well
Phillips Lee Plant



6.0 Recommendations

Additional wells will be installed to characterize the quality of ground water entering the site, leaving the site, and upgradient and downgradient of monitor well MW-6, where free-phase hydrocarbons have been detected. All wells will be designed for potential use in a final remedial action at the site (figure 1). The proposed monitor well locations are shown on plate 2. Objectives for the proposed monitor well locations are as follows:

- Install one monitor well, P1, down-gradient of the north evaporation pond (plate 2). The monitor well at this location has been requested by NMOCD.

- Install one monitor well, P2, upgradient of the north evaporation pond. This location will allow Phillips to characterize the ground-water upgradient of the north evaporation pond and the plant.

- Install two monitor wells, P3 and P4, up-gradient of the plant, south of the county road that is just north of the plant. These wells will enable Phillips to characterize the ground-water entering the plant upgradient of water-supply well WS-1. Additionally, Phillips will be able to investigate the lateral extent of dissolved-phase petroleum constituents associated with the free-phase hydrocarbon located southeast of the north evaporation pond.

- Install two monitor wells, P5 and P6, down-gradient of the Plant. Monitor wells at these proposed locations will allow Phillips to characterize the quality of the ground-water down-gradient of the plant.

SECTION 7.0

7.0 Schedule

The following schedule is proposed for implementing the next phase of the investigation.

- Following NMOCD approval, install the proposed monitor wells. Ideally, the quarterly sampling event will be coordinated with sampling the ground-water from the proposed monitor wells. The proposed monitor well installation and sampling, pending on NMOCD approval, and the quarterly sampling, will be completed by October 21, 1991.

- Following evaluation of the analytical data, a remedial strategy for the site will be prepared. The first step in this process will be to evaluate the results of the proposed drilling program and the quarterly sampling. Based on these data, we will develop several remedial alternatives. Phillips will submit the sampling results, along with a remedial strategy report to NMOCD by January 20, 1992.

SECTION 8.0

8.0 References

Geoscience Consultants, Ltd., For Phillips Petroleum Company, 1988a, "Report On The Installation Of A Ground Water Monitoring System at Phillips 66 Natural Gas Company," June 6, 1988.

Geoscience Consultants, Ltd., For Phillips Petroleum Company, 1988b, "Draft Limited Soil Vapor Survey, Phillips Lee Gas Plant," September 23, 1988.

Geoscience Consultants, Ltd., For Phillips Petroleum Company, 1988c, "Sampling and Analyses Plan for Phillips 66 Natural Gas Company Artesia, Eunice, Lee and Lusk Gasoline Plants," June 3, 1988.

Geoscience Consultants, Ltd., For Phillips Petroleum Company, 1990a, "Report of Subsurface Investigation Phillips 66 Natural Gas Company Lee Gas Plant," May 30, 1990.

Geoscience Consultants, Ltd., For Phillips Petroleum Company, 1990b, "Phase II Report of Subsurface Investigation Phillips 66 Natural Gas Company Lee Gas Plant," October 9, 1990.

Geoscience Consultants, Ltd., For Phillips Petroleum Company, 1991, "Phase III Report of Subsurface Investigation Phillips 66 Natural Gas Company Lee Gas Plant." March 11, 1990.

New Mexico Oil Conservation Division, To Phillips Petroleum Company, 1991, RE: Report of Subsurface Investigation Phillips 66 Natural Gas Company Lee Gas Plant Buckeye, New Mexico, Letter, April 2, 1991.

APPENDIX A

Appendix A

Laboratory Reports

Analytical Technologies, Inc.

ACCESSION #: 106982

PARAMETER	METHOD	DATE EXTRACTED	DATE ANALYZED	ANALYST
Fuel Hydrocarbons	8015 Mod	07/02/91	07/23/91	D. McKee
BTEX	602	NA	07/09/91 07/12/91	EN

Reference(s): Methods for Chemical Analysis of Water and Wastes
March 1983 EPA-600 4-79-020

SW 846, 3rd Edition

Analytical Technologies, Inc.

CLIENT	: GEOSCIENCE CONSULTANTS	DATE RECEIVED	: 06/29/91
PROJECT #	: C.O.C 4121		
PROJECT NAME	: PHILLIPS	REPORT DATE	: 08/22/91

ATI I.D. : 106982

ATI #	CLIENT DESCRIPTION	MATRIX	DATE COLLECTED
01	9106271550 MW-1	AQUEOUS	06/27/91
02	9106271650 MW-7	AQUEOUS	06/27/91
03	9106271710 MW-10	AQUEOUS	06/27/91
04	9106271525 RINSATE	AQUEOUS	06/27/91
05	9106271735 MW-8	AQUEOUS	06/27/91
06	9106281000 TRIP BLANK	AQUEOUS	06/28/91

----- TOTALS -----

MATRIX	# SAMPLES
AQUEOUS	6

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of this report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

AnalyticalTechnologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10698201

TEST : FUEL HYDROCARBONS (MODIFIED EPA METHOD 8015)

CLIENT	: GEOSCIENCE CONSULTANTS	DATE SAMPLED	: 06/27/91
PROJECT #	: C.O.C 4121	DATE RECEIVED	: 06/29/91
PROJECT NAME	: PHILLIPS	DATE EXTRACTED	: 07/02/91
CLIENT I.D.	: 9106271550 MW-1	DATE ANALYZED	: 07/23/91
SAMPLE MATRIX	: AQUEOUS	UNITS	: UG/L
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	330
HYDROCARBON RANGE	C10-C36+
HYDROCARBONS QUANTITATED USING	DIESEL

SURROGATE PERCENT RECOVERIES

DI-N-OCTYL-PHTHALATE (%)	77

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10698202

TEST : FUEL HYDROCARBONS (MODIFIED EPA METHOD 8015)

CLIENT	: GEOSCIENCE CONSULTANTS	DATE SAMPLED	: 06/27/91
PROJECT #	: C.O.C 4121	DATE RECEIVED	: 06/29/91
PROJECT NAME	: PHILLIPS	DATE EXTRACTED	: 07/02/91
CLIENT I.D.	: 9106271650 MW-7	DATE ANALYZED	: 07/23/91
SAMPLE MATRIX	: AQUEOUS	UNITS	: UG/L
		DILUTION FACTOR	: 2

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	660
HYDROCARBON RANGE	C10-C36+
HYDROCARBONS QUANTITATED USING	DIESEL

SURROGATE PERCENT RECOVERIES

DI-N-OCTYL-PHTHALATE (%)	75

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10698203

TEST : FUEL HYDROCARBONS (MODIFIED EPA METHOD 8015)

CLIENT	: GEOSCIENCE CONSULTANTS	DATE SAMPLED	: 06/27/91
PROJECT #	: C.O.C 4121	DATE RECEIVED	: 06/29/91
PROJECT NAME	: PHILLIPS	DATE EXTRACTED	: 07/02/91
CLIENT I.D.	: 9106271710 MW-10	DATE ANALYZED	: 07/23/91
SAMPLE MATRIX	: AQUEOUS	UNITS	: UG/L
		DILUTION FACTOR	: 5

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	1300
HYDROCARBON RANGE	C10-C36
HYDROCARBONS QUANTITATED USING	DIESEL

SURROGATE PERCENT RECOVERIES

DI-N-OCTYL-PHTHALATE (%)	65

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10698204

TEST : FUEL HYDROCARBONS (MODIFIED EPA METHOD 8015)

CLIENT	: GEOSCIENCE CONSULTANTS	DATE SAMPLED	: 06/27/91
PROJECT #	: C.O.C 4121	DATE RECEIVED	: 06/29/91
PROJECT NAME	: PHILLIPS	DATE EXTRACTED	: 07/02/91
CLIENT I.D.	: 9106271525 RINSATE	DATE ANALYZED	: 07/23/91
SAMPLE MATRIX	: AQUEOUS	UNITS	: UG/L
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	<50
HYDROCARBON RANGE	-
HYDROCARBONS QUANTITATED USING	-
SURROGATE PERCENT RECOVERIES	
DI-N-OCTYL-PHTHALATE (%)	93

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10698205

TEST : FUEL HYDROCARBONS (MODIFIED EPA METHOD 8015)

CLIENT	: GEOSCIENCE CONSULTANTS	DATE SAMPLED	: 06/27/91
PROJECT #	: C.O.C 4121	DATE RECEIVED	: 06/29/91
PROJECT NAME	: PHILLIPS	DATE EXTRACTED	: 07/02/91
CLIENT I.D.	: 9106271735 MW-8	DATE ANALYZED	: 07/23/91
SAMPLE MATRIX	: AQUEOUS	UNITS	: UG/L
		DILUTION FACTOR	: 5

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	1400
HYDROCARBON RANGE	C10-C36
HYDROCARBONS QUANTITATED USING	DIESEL

SURROGATE PERCENT RECOVERIES

DI-N-OCTYL-PHTHALATE (%)	90

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

REAGENT BLANK

TEST : FUEL HYDROCARBONS (MODIFIED EPA METHOD 8015)

		ATI I.D.	: 106982
CLIENT	: GEOSCIENCE CONSULTANTS	DATE EXTRACTED	: 07/02/91
PROJECT #	: C.O.C 4121	DATE ANALYZED	: 07/23/91
PROJECT NAME	: PHILLIPS	UNITS	: UG/L
CLIENT I.D.	: REAGENT BLANK	DILUTION FACTOR	: N/A

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	58
HYDROCARBON RANGE	C10-C32
HYDROCARBONS QUANTITATED USING	DIESEL

SURROGATE PERCENT RECOVERIES

DI-N-OCTYL-PHTHALATE (%)	90

Analytical Technologies, Inc.

QUALITY CONTROL DATA

ATI I.D. : 106982

TEST : FUEL HYDROCARBONS (MODIFIED EPA METHOD 8015)

CLIENT : GEOSCIENCE CONSULTANTS
PROJECT # : C.O.C 4121
PROJECT NAME : PHILLIPS
REF I.D. : 10799828

DATE ANALYZED : 07/24/91
SAMPLE MATRIX :
UNITS : UG/L

COMPOUNDS	SAMPLE RESULT	CONC. SPIKED	SPIKED SAMPLE	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
FUEL HYDROCARBONS	<5	278	389	140	329	118	17

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Spiked Sample Result} - \text{Duplicate Spike Sample Result})}{\text{Average of Spiked Sample}} \times 100$$

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10698201

TEST : BTEX & MTBE (EPA METHOD 8020)

CLIENT	: GEOSCIENCE CONSULTANTS	DATE SAMPLED	: 06/27/91
PROJECT #	: C.O.C 4121	DATE RECEIVED	: 06/29/91
PROJECT NAME	: PHILLIPS	DATE EXTRACTED	: N/A
CLIENT I.D.	: 9106271550 MW-1	DATE ANALYZED	: 07/09/91
SAMPLE MATRIX	: AQUEOUS	UNITS	: UG/L
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	<1.5
TOLUENE	<1.5
ETHYLBENZENE	<1.5
TOTAL XYLENES	<2.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE (%)	100

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10698202

TEST : BTEX & MTBE (EPA METHOD 8020)

CLIENT	: GEOSCIENCE CONSULTANTS	DATE SAMPLED	: 06/27/91
PROJECT #	: C.O.C 4121	DATE RECEIVED	: 06/29/91
PROJECT NAME	: PHILLIPS	DATE EXTRACTED	: N/A
CLIENT I.D.	: 9106271650 MW-7	DATE ANALYZED	: 07/09/91
SAMPLE MATRIX	: AQUEOUS	UNITS	: UG/L
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	3200 D
TOLUENE	1400 D
ETHYLBENZENE	23
TOTAL XYLENES	130

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE (%)	105

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10698203

TEST : BTEX & MTBE (EPA METHOD 8020)

CLIENT	: GEOSCIENCE CONSULTANTS	DATE SAMPLED	: 06/27/91
PROJECT #	: C.O.C 4121	DATE RECEIVED	: 06/29/91
PROJECT NAME	: PHILLIPS	DATE EXTRACTED	: N/A
CLIENT I.D.	: 9106271710 MW-10	DATE ANALYZED	: 07/09/91
SAMPLE MATRIX	: AQUEOUS	UNITS	: UG/L
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	9700 D
TOLUENE	420 D
ETHYLBENZENE	84
TOTAL XYLENES	39

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE (%)	114

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10698204

TEST : BTEX & MTBE (EPA METHOD 8020)

CLIENT	: GEOSCIENCE CONSULTANTS	DATE SAMPLED	: 06/27/91
PROJECT #	: C.O.C 4121	DATE RECEIVED	: 06/29/91
PROJECT NAME	: PHILLIPS	DATE EXTRACTED	: N/A
CLIENT I.D.	: 9106271525 RINSATE	DATE ANALYZED	: 07/09/91
SAMPLE MATRIX	: AQUEOUS	UNITS	: UG/L
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	<1.5
TOLUENE	<1.5
ETHYLBENZENE	<1.5
TOTAL XYLENES	<2.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE (%)	103

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10698205

TEST : BTEX & MTBE (EPA METHOD 8020)

CLIENT	: GEOSCIENCE CONSULTANTS	DATE SAMPLED	: 06/27/91
PROJECT #	: C.O.C 4121	DATE RECEIVED	: 06/29/91
PROJECT NAME	: PHILLIPS	DATE EXTRACTED	: N/A
CLIENT I.D.	: 9106271735 MW-8	DATE ANALYZED	: 07/09/91
SAMPLE MATRIX	: AQUEOUS	UNITS	: UG/L
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	21000 D
TOLUENE	1300 D
ETHYLBENZENE	12
TOTAL XYLENES	420 D

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE (%)	80

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10698206

TEST : BTEX & MTBE (EPA METHOD 8020)

CLIENT	: GEOSCIENCE CONSULTANTS	DATE SAMPLED	: 06/28/91
PROJECT #	: C.O.C 4121	DATE RECEIVED	: 06/29/91
PROJECT NAME	: PHILLIPS	DATE EXTRACTED	: N/A
CLIENT I.D.	: 9106281000 TRIP BLANK	DATE ANALYZED	: 07/12/91
SAMPLE MATRIX	: AQUEOUS	UNITS	: UG/L
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	<1.5
TOLUENE	<1.5
ETHYLBENZENE	<1.5
TOTAL XYLENES	<2.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE (%)	96

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

REAGENT BLANK

TEST : BTEX & MTBE (EPA METHOD 8020)

CLIENT	: GEOSCIENCE CONSULTANTS	ATI I.D.	: 106982
PROJECT #	: C.O.C 4121	DATE EXTRACTED	: 07/09/91
PROJECT NAME	: PHILLIPS	DATE ANALYZED	: 07/09/91
CLIENT I.D.	: REAGENT BLANK	UNITS	: UG/L
		DILUTION FACTOR	: N/A

COMPOUNDS	RESULTS
BENZENE	<1.5
TOLUENE	<1.5
ETHYLBENZENE	<1.5
TOTAL XYLENES	<2.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE (%)	98

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

REAGENT BLANK

TEST : BTEX & MTBE (EPA METHOD 8020)

CLIENT	: GEOSCIENCE CONSULTANTS	ATI I.D.	: 106982
PROJECT #	: C.O.C 4121	DATE EXTRACTED	: 07/12/91
PROJECT NAME	: PHILLIPS	DATE ANALYZED	: 07/12/91
CLIENT I.D.	: REAGENT BLANK	UNITS	: UG/L
		DILUTION FACTOR	: N/A

COMPOUNDS	RESULTS
BENZENE	<1.5
TOLUENE	<1.5
ETHYLBENZENE	<1.5
TOTAL XYLENES	<2.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE (%)	106

AnalyticalTechnologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

REAGENT BLANK

TEST : BTEX & MTBE (EPA METHOD 8020)

		ATI I.D.	: 106982
CLIENT	: GEOSCIENCE CONSULTANTS	DATE EXTRACTED	: 07/12/91
PROJECT #	: C.O.C 4121	DATE ANALYZED	: 07/12/91
PROJECT NAME	: PHILLIPS	UNITS	: UG/L
CLIENT I.D.	: REAGENT BLANK	DILUTION FACTOR	: N/A

COMPOUNDS	RESULTS
BENZENE	<1.5
TOLUENE	<1.5
ETHYLBENZENE	<1.5
TOTAL XYLENES	<2.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE (%)	96

Analytical Technologies, Inc.

QUALITY CONTROL DATA

ATI I.D. : 106982

TEST : BTEX & MTBE (EPA METHOD 8020)

CLIENT : GEOSCIENCE CONSULTANTS
PROJECT # : C.O.C 4121
PROJECT NAME : PHILLIPS
REF I.D. : 10698201

DATE ANALYZED : 07/09/91
SAMPLE MATRIX : AQUEOUS
UNITS : UG/L

COMPOUNDS	SAMPLE RESULT	CONC. SPIKED	SPIKED SAMPLE	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
BENZENE	<0.5	20.0	19.0	95	20.5	103	8
TOLUENE	<0.5	20.0	21.2	106	22.8	114	7
ETHYLBENZENE	NA	NA	NA	NA	NA	NA	NA
TOTAL XYLENES	<0.5	40.0	42.9	107	46.1	115	7

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Spiked Sample Result} - \text{Duplicate Spike Sample Result})}{\text{Average of Spiked Sample}} \times 100$$

Geoscience Consultants, Ltd.

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Las Cruces, NM 88004
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№ 4121

Chain of Custody

DATE 6/28 PAGE 1 OF 1

LAB NAME Analytical Technologies, Inc.
ADDRESS 9830 South 51st St., Ste B-111
Phoenix, AZ 85044
TELEPHONE 602/496-4400

SAMPLERS (SIGNATURE) [signature]

ANALYSIS REQUEST

SAMPLE NUMBER	MATRIX	LOCATION	BASE/NEU/ACID CMPDS. GC/MS/ 625/8270	VOLATILE CMPDS. GC/MS/ 624/8240	PESTICIDES/PCB 608/8080	POLYNUCLEAR AROMATIC 610/8310	PHENOLS, SUB PHENOLS 604/8040	HALOGENATED VOLATILES 601/8010	AROMATIC VOLATILES 602/8020	TOTAL ORGANIC CARBON 415/9060	TOTAL ORGANIC HALIDES 9020	PETROLEUM HYDROCARBONS 418.1	TPH ~~BTEX~~ MODIFIED 8015		PRIORITY POLLUTANT METALS (13)	CAM METALS (18) TTLC/STLC	EP TOX METALS (8)	SDWA-INORGANICS PRIMARY/SECONDARY	HAZARDOUS WASTE PROFILE				NUMBER OF CONTAINERS
9106271550	H_2O	MW-1											4										4
9106271650	H_2O	MW-7											4										4
9106271710	H_2O	MW-10											4										4
9106271525	H_2O	rinsate											4										4
9106271735	H_2O	MW-8											4										4
9106281000	H_2O												1										1

PROJECT INFORMATION

PROJECT: Phillips
PROJECT DIRECTOR: M. Nee
CHARGE CODE NO. 528-000
SHIPPING ID. NO. 6664830056
VIA: Fdx

SAMPLE RECEIPT

TOTAL NO. OF CONTAINERS	21
CHAIN OF CUSTODY SEALS	Y
REC'D GOOD CONDITION/COLD	Y
CONFORMS TO RECORD	Y

LAB NO. 106982

RELINQUISHED BY 1.	RELINQUISHED BY 2.	RELINQUISHED BY 3.
[signature] (Signature) 1030 (Time)	(Signature) (Time)	(Signature) (Time)
KYLE SUMMERS (Printed Name) 6/21 (Date)	(Printed Name) (Date)	(Printed Name) (Date)
GCL (Company)	(Company)	(Company)

RECEIVED BY 1.	RECEIVED BY 2.	RECEIVED BY (LABORATORY) 3.
(Signature) (Time)	(Signature) (Time)	Marcia Smith (Signature) 10:30 am (Time)
(Printed Name) (Date)	(Printed Name) (Date)	MARCIA SMITH (Printed Name) 6/29/91 date
(Company)	(Company)	ATI ANALYTI

SPECIAL INSTRUCTIONS/COMMENTS:
Det. limits
TPH - 50ppb
Benzene - 2ppb
Ethyl/B - 5ppb
Toluene - 5ppb
Xylenes - 5ppb

Received 2-1 L Ambers and 2-40 ml VOAs for each sample. [initials] 6/29/91. Headspace in Ambers.

DISTRIBUTION: WHITE, CANARY - LABORATORY • PINK - GEOSCIENCE CONSULTANTS, LTD.

9107-006-002

Analytical Technologies, Inc.
Phoenix, Arizona

Chain of Custody

DATE 7/5/91 PAGE 1 OF 1

PROJECT MANAGER: Rebecca Tubeszewski (MT)

COMPANY: ATI Phoenix
ADDRESS:

BILL TO:
COMPANY:
ADDRESS:

SAMPLERS: (Signature)

PHONE NUMBER ( ) .

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	BTXE (8020) + MTBE	NUMBER OF CONTAINERS
10698201	6/27/91	1550	H_2O	-1	✓	2
10698202	6/27/91	1650	H_2O	-2	✓	2
10698203	6/27/91	1710	H_2O	-3	✓	2
10698204	6/27/91	1525	H_2O	-4	✓	2
10698205	6/27/91	1735	H_2O	-5	✓	2
10698206 Trip blank	6/27/91	1000	H_2O	-6	✓	1

Other analyses listed (not requested): Petroleum Hydrocarbons (418.1); (MOD 8015) Gas/Diesel; Diesel/Gasoline/BTXE (MOD 8015/8020); Chlorinated Hydrocarbons (601/8010); Aromatic Hydrocarbons (602/8020); MTBE; Pesticides/PCB (608/8080); Herbicides (615/8150); Base/Neutral/Acid Compounds GC/MS (625/8270); Volatile Organics GC/MS (624/8240); SDWA Primary Standards; SDWA Secondary Standards; SDWA Volatiles (502.1/503.1); The 13 Priority Pollutant Metals; The 8 EP Tox Metals by EP Tox Prep. (1310); The 8 EP Tox Metals by Total Digestion; The 8 EP Tox Metals by TCLP (1311)

PROJECT INFORMATION		SAMPLE RECEIPT	
PROJECT NO:	106982	TOTAL NO. OF CONTAINERS	12
PROJECT NAME:	GCL	CHAIN OF CUSTODY SEALS	Y
P.O. NO.		INTACT?	Y
SHIPPED VIA:		RECEIVED GOOD COND./COLD	Y
SAMPLE DISPOSAL INSTRUCTIONS		LAB NUMBER	
☐ ATI ☐ RETURN			

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

TAT: (NORMAL) (RUSH) ☐ 24 ☐ 48 ☐ 72 ☐ 1 WEEK

Comments: 10% Client discount
Lab due 7/9/91

RELINQUISHED BY: 1.	RELINQUISHED BY: 2.	RELINQUISHED BY: 3.
Signature: Mary H Tyer Time: 3:15	Signature: Time:	Signature: Time:
Printed Name: Mary Tyer Date: 7/5/91	Printed Name: Date	Printed Name: Date
Company: ATI PHX	Company:	Company:

RECEIVED BY: 1.	RECEIVED BY: 2.	RECEIVED BY: (LAB) 3.
Signature: P. Nicholls Time: 9:40	Signature: Time:	Signature: Time:
Printed Name: P. Nicholls Date: 7/6/91	Printed Name: Date:	Printed Name: Date:
Company: ATI Rapitor	Company:	Analytical Technologies, Inc.

Analytical Technologies, Inc.

ACCESSION #: 106983

PARAMETER	METHOD	DATE EXTRACTED	DATE ANALYZED	ANALYST
Fuel Hydrocarbons	8015 Mod	07/02/91	07/23/91	D. McKee
BTEX	602	NA	07/09/91	GB, EE

Reference(s): Methods for Chemical Analysis of Water and Wastes
March 1983 EPA-600 4-79-020

SW 846, 3'rd Edition

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10698301

TEST : FUEL HYDROCARBONS (MODIFIED EPA METHOD 8015)

CLIENT	: GEOSCIENCE CONSULTANTS	DATE SAMPLED	: 06/27/91
PROJECT #	: C.O.C. 4122	DATE RECEIVED	: 06/29/91
PROJECT NAME	: PHILLIPS	DATE EXTRACTED	: 07/02/91
CLIENT I.D.	: 9106271755 WS-1	DATE ANALYZED	: 07/23/91
SAMPLE MATRIX	: AQUEOUS	UNITS	: UG/L
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	64
HYDROCARBON RANGE	C10-C32
HYDROCARBONS QUANTITATED USING	DIESEL

SURROGATE PERCENT RECOVERIES

DI-N-OCTYL-PHTHALATE (%)	95

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10698302

TEST : FUEL HYDROCARBONS (MODIFIED EPA METHOD 8015)

CLIENT	: GEOSCIENCE CONSULTANTS	DATE SAMPLED	: 06/27/91
PROJECT #	: C.O.C. 4122	DATE RECEIVED	: 06/29/91
PROJECT NAME	: PHILLIPS	DATE EXTRACTED	: 07/02/91
CLIENT I.D.	: 9106271350 MW-3	DATE ANALYZED	: 07/23/91
SAMPLE MATRIX	: AQUEOUS	UNITS	: UG/L
		DILUTION FACTOR	: 2

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	750
HYDROCARBON RANGE	C10-C36
HYDROCARBONS QUANTITATED USING	DIESEL

SURROGATE PERCENT RECOVERIES

DI-N-OCTYL-PHTHALATE (%)	71

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10698303

TEST : FUEL HYDROCARBONS (MODIFIED EPA METHOD 8015)

CLIENT	: GEOSCIENCE CONSULTANTS	DATE SAMPLED	: 06/27/91
PROJECT #	: C.O.C. 4122	DATE RECEIVED	: 06/29/91
PROJECT NAME	: PHILLIPS	DATE EXTRACTED	: 07/02/91
CLIENT I.D.	: 9106271520 MW-2	DATE ANALYZED	: 07/23/91
SAMPLE MATRIX	: AQUEOUS	UNITS	: UG/L
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	480
HYDROCARBON RANGE	C10-C36+
HYDROCARBONS QUANTITATED USING	DIESEL
SURROGATE PERCENT RECOVERIES	
DI-N-OCTYL-PHTHALATE (%)	95

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10698304

TEST : FUEL HYDROCARBONS (MODIFIED EPA METHOD 8015)

CLIENT	: GEOSCIENCE CONSULTANTS	DATE SAMPLED	: 06/27/91
PROJECT #	: C.O.C. 4122	DATE RECEIVED	: 06/29/91
PROJECT NAME	: PHILLIPS	DATE EXTRACTED	: 07/02/91
CLIENT I.D.	: 9106271332 FIELD BLANK	DATE ANALYZED	: 07/23/91
SAMPLE MATRIX	: AQUEOUS	UNITS	: UG/L
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	98
HYDROCARBON RANGE	C10-C36
HYDROCARBONS QUANTITATED USING	DIESEL
SURROGATE PERCENT RECOVERIES	
DI-N-OCTYL-PHTHALATE (%)	85

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

REAGENT BLANK

TEST : FUEL HYDROCARBONS (MODIFIED EPA METHOD 8015)

		ATI I.D.	: 106983
CLIENT	: GEOSCIENCE CONSULTANTS	DATE EXTRACTED	: 07/02/91
PROJECT #	: C.O.C. 4122	DATE ANALYZED	: 07/23/91
PROJECT NAME	: PHILLIPS	UNITS	: UG/L
CLIENT I.D.	: REAGENT BLANK	DILUTION FACTOR	: N/A

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	58
HYDROCARBON RANGE	C10-C32
HYDROCARBONS QUANTITATED USING	DIESEL

SURROGATE PERCENT RECOVERIES

DI-N-OCTYL-PHTHALATE (%)	90

Analytical Technologies, Inc.

QUALITY CONTROL DATA

ATI I.D. : 106983

TEST : FUEL HYDROCARBONS (MODIFIED EPA METHOD 8015)

CLIENT : GEOSCIENCE CONSULTANTS
PROJECT # : C.O.C. 4122
PROJECT NAME : PHILLIPS
REF I.D. : 10799828

DATE ANALYZED : 07/24/91
SAMPLE MATRIX :
UNITS : UG/L

COMPOUNDS	SAMPLE RESULT	CONC. SPIKED	SPIKED SAMPLE	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
FUEL HYDROCARBONS	<5	278	389	140	329	118	17

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Spiked Sample Result} - \text{Duplicate Spike Sample Result})}{\text{Average of Spiked Sample}} \times 100$$

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10698301

TEST : BTEX & MTBE (EPA METHOD 8020)

CLIENT	: GEOSCIENCE CONSULTANTS	DATE SAMPLED	: 06/27/91
PROJECT #	: C.O.C. 4122	DATE RECEIVED	: 06/29/91
PROJECT NAME	: PHILLIPS	DATE EXTRACTED	: N/A
CLIENT I.D.	: 9106271755 WS-1	DATE ANALYZED	: 07/09/91
SAMPLE MATRIX	: AQUEOUS	UNITS	: UG/L
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	6.5
TOLUENE	<1.5
ETHYLBENZENE	<1.5
TOTAL XYLENES	<2.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE (%)	91

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10698302

TEST : BTEX & MTBE (EPA METHOD 8020)

CLIENT	: GEOSCIENCE CONSULTANTS	DATE SAMPLED	: 06/27/91
PROJECT #	: C.O.C. 4122	DATE RECEIVED	: 06/29/91
PROJECT NAME	: PHILLIPS	DATE EXTRACTED	: N/A
CLIENT I.D.	: 9106271350 MW-3	DATE ANALYZED	: 07/09/91
SAMPLE MATRIX	: AQUEOUS	UNITS	: UG/L
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	43
TOLUENE	5.7
ETHYLBENZENE	1.5
TOTAL XYLENES	<2.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE (%)	104

AnalyticalTechnologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10698303

TEST : BTEX & MTBE (EPA METHOD 8020)

CLIENT	: GEOSCIENCE CONSULTANTS	DATE SAMPLED	: 06/27/91
PROJECT #	: C.O.C. 4122	DATE RECEIVED	: 06/29/91
PROJECT NAME	: PHILLIPS	DATE EXTRACTED	: N/A
CLIENT I.D.	: 9106271520 MW-2	DATE ANALYZED	: 07/09/91
SAMPLE MATRIX	: AQUEOUS	UNITS	: UG/L
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	<1.5
TOLUENE	<1.5
ETHYLBENZENE	<1.5
TOTAL XYLENES	<2.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE (%)	100

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10698304

TEST : BTEX & MTBE (EPA METHOD 8020)

CLIENT	: GEOSCIENCE CONSULTANTS	DATE SAMPLED	: 06/27/91
PROJECT #	: C.O.C. 4122	DATE RECEIVED	: 06/29/91
PROJECT NAME	: PHILLIPS	DATE EXTRACTED	: N/A
CLIENT I.D.	: 9106271332 FIELD BLANK	DATE ANALYZED	: 07/09/91
SAMPLE MATRIX	: AQUEOUS	UNITS	: UG/L
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	<1.5
TOLUENE	<1.5
ETHYLBENZENE	<1.5
TOTAL XYLENES	<2.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE (%)	98

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10698305

TEST : BTEX & MTBE (EPA METHOD 8020)

CLIENT	: GEOSCIENCE CONSULTANTS	DATE SAMPLED	: 06/28/91
PROJECT #	: C.O.C. 4122	DATE RECEIVED	: 06/29/91
PROJECT NAME	: PHILLIPS	DATE EXTRACTED	: N/A
CLIENT I.D.	: 9106280800 TRIP BLANK	DATE ANALYZED	: 07/09/91
SAMPLE MATRIX	: AQUEOUS	UNITS	: UG/L
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	<1.5
TOLUENE	<1.5
ETHYLBENZENE	<1.5
TOTAL XYLENES	<2.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE (%)	98

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

REAGENT BLANK

TEST : BTEX & MTBE (EPA METHOD 8020)

		ATI I.D.	: 106983
CLIENT	: GEOSCIENCE CONSULTANTS	DATE EXTRACTED	: 07/08/91
PROJECT #	: C.O.C. 4122	DATE ANALYZED	: 07/08/91
PROJECT NAME	: PHILLIPS	UNITS	: UG/L
CLIENT I.D.	: REAGENT BLANK	DILUTION FACTOR	: N/A

COMPOUNDS	RESULTS
BENZENE	<1.5
TOLUENE	<1.5
ETHYLBENZENE	<1.5
TOTAL XYLENES	<2.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE (%)	101

Analytical Technologies, Inc.

QUALITY CONTROL DATA

ATI I.D. : 106983

TEST : BTEX & MTBE (EPA METHOD 8020)

CLIENT : GEOSCIENCE CONSULTANTS
PROJECT # : C.O.C. 4122
PROJECT NAME : PHILLIPS
REF I.D. : 10799808

DATE ANALYZED : 07/09/91
SAMPLE MATRIX :
UNITS : UG/L

COMPOUNDS	SAMPLE RESULT	CONC. SPIKED	SPIKED SAMPLE	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
BENZENE	<0.5	20.0	19.0	95	20.5	103	8
TOLUENE	<0.5	20.0	21.2	106	22.8	114	7
ETHYLBENZENE	NA	NA	NA	NA	NA	NA	NA
TOTAL XYLENES	<0.5	40.0	42.9	107	46.1	115	7

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Spiked Sample Result} - \text{Duplicate Spike Sample Result})}{\text{Average of Spiked Sample}} \times 100$$

Geoscience Consultants, Ltd.

[X] Albuquerque, 500 Copper N.W., Suite 200, Albuquerque, NM 87102, (505) 842-0001
[ ] East Coast, 4221 Forbes Blvd., Suite 240, Lanham, MD 20706, (301) 459-9677
[ ] Rocky Mountain, 13111 E. Briarwood Ave., Suite 250, Englewood, CO 80112, (303) 649-9001
[ ] Las Cruces, P.O. Drawer MM, Las Cruces, NM 88004, (505) 524-5364

№ 4122

Chain of Custody

DATE 6/28/91 PAGE 1 OF 1

LAB NAME Analytical Technologies, Inc.
ADDRESS 9830 South 51st St., Ste B-11
Phoenix, AZ 85044
TELEPHONE 602/496-4400

SAMPLERS (SIGNATURE) [signature]

ANALYSIS REQUEST

	SAMPLE NUMBER	MATRIX	LOCATION	BASE/NEU/ACID CMPDS. GC/MS/ 625/8270	VOLATILE CMPDS. GC/MS/ 624/8240	PESTICIDES/PCB 608/8080	POLYNUCLEAR AROMATIC 610/8310	PHENOLS, SUB PHENOLS 604/8040	HALOGENATED VOLATILES 601/8010	AROMATIC VOLATILES 602/8020	TOTAL ORGANIC CARBON 415/9060	TOTAL ORGANIC HALIDES 9020	PETROLEUM HYDROCARBONS 418.1	TPH BTEX MODIFIED 8015		PRIORITY POLLUTANT METALS (13)	CAM METALS (18) TTLC/STLC	EP TOX METALS (8)	SDWA-INORGANICS PRIMARY/SECONDARY	HAZARDOUS WASTE PROFILE				NUMBER OF CONTAINERS
1	9106271755	H_2O	WS-1											4										4
2	9106271350	H_2O	MW-3											4										4
3	9106271520	H_2O	MW-2											4										4
4	9106271332	H_2O	Field Blk.											4										4
5	9106280800	H_2O												1										1

PROJECT INFORMATION

PROJECT: Phillips
PROJECT DIRECTOR M. Wee
CHARGE CODE NO. 528-000
SHIPPING ID. NO. 666483 0045
VIA: Fed EX

SAMPLE RECEIPT

TOTAL NO. OF CONTAINERS	17
CHAIN OF CUSTODY SEALS	Y
REC'D GOOD CONDITION/COLD	Y
CONFORMS TO RECORD	Y

LAB NO. 106983

RELINQUISHED BY 1.	RELINQUISHED BY 2.	RELINQUISHED BY 3.
(Signature) [signature] (Time) 1023	(Signature) (Time)	(Signature) (Time)
(Printed Name) LYLE SUMMERS (Date) 6/28/91	(Printed Name) (Date)	(Printed Name) (Date)
(Company) GCL	(Company)	(Company)

RECEIVED BY 1.	RECEIVED BY 2.	RECEIVED BY (LABORATORY) 3.
(Signature) (Time)	(Signature) (Time)	(Signature) Marcia Smith (Time) 1030
(Printed Name) (Date)	(Printed Name) (Date)	(Printed Name) MARCIA SMITH (Date) 6/29/91
(Company)	(Company)	(Company) ATI ANALYTI

SPECIAL INSTRUCTIONS/COMMENTS:
-Detection Limits
-TPH - 50ppb
Benzene 2ppb
Ethyl B 5ppb
Toluene 5ppb
Xylenes 5ppb

Received 2 1-L Ambers and 2-40 ml VOA's, ... Ambers with headspace. MSmith 6/29

DISTRIBUTION: WHITE, CANARY - LABORATORY • PINK - GEOSCIENCE CONSULTANTS, LTD

(58

Analytical Technologies, Inc.
Phoenix, Arizona

WA

Chain of Custody

DATE 7/5/91 PAGE 1 OF 1

PROJECT MANAGER: Rebecca Tubesceuski (MT)

COMPANY: ATI - Phoenix
ADDRESS:

BILL TO:
COMPANY:
ADDRESS:

SAMPLERS: (Signature)

PHONE NUMBER ( ) .

ANALYSIS REQUEST

Petroleum Hydrocarbons (418.1); (MOD 8015) Gas/Diesel; Diesel/Gasoline/BTXE (MOD 8015/8020); BTXE (8020) + MTBE; Chlorinated Hydrocarbons (601/8010); Aromatic Hydrocarbons (602/8020); MTBE; Pesticides/PCB (608/8080); Herbicides (615/8150); Base/Neutral/Acid Compounds GC/MS (625/8270); Volatile Organics GC/MS (624/8240); SDWA Primary Standards; SDWA Secondary Standards; SDWA Volatiles (502.1/503.1); The 13 Priority Pollutant Metals; The 8 EP Tox Metals by EP Tox Prep. (1310); The 8 EP Tox Metals by Total Digestion; The 8 EP Tox Metals by TCLP (1311); NUMBER OF CONTAINERS

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	BTXE (8020) + MTBE	NUMBER OF CONTAINERS
10698301	6/27/91	1235	H_2O		✓	2
10698302	6/27/91	1350	H_2O		✓	2
~~10698???~~ 10698303	6/27/91	1520	H_2O		✓	2
10698304	6/27/91	1332	H_2O		✓	2
10698305 trip blank	6/25/91	0800	H_2O		✓	1

PROJECT INFORMATION	
PROJECT NO:	106983
PROJECT NAME:	GCL
P.O. NO.	
SHIPPED VIA:	
SAMPLE DISPOSAL INSTRUCTIONS	☐ ATI ☐ RETURN

SAMPLE RECEIPT	
TOTAL NO. OF CONTAINERS	
CHAIN OF CUSTODY SEALS	
INTACT?	
RECEIVED GOOD COND./COLD	
LAB NUMBER	

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

TAT: (NORMAL) (RUSH) ☐ 24 ☐ 48 ☐ 72 ☐ 1 WEEK

Comments: 10% Client Discount
Lab due 7/19/91 / Int. due 7/10

RELINQUISHED BY: 1.	RELINQUISHED BY: 2.	RELINQUISHED BY: 3.
Signature: [signature] Time: 3:20	Signature: Time:	Signature: Time:
Printed Name: Mary Tyer Date 7/5/91	Printed Name: Date	Printed Name: Date
Company: ATI	Company:	Company:

RECEIVED BY: 1.	RECEIVED BY: 2.	RECEIVED BY: (LAB) 3.
Signature: Time:	Signature: Time:	Signature: Time:
Printed Name: Date:	Printed Name: Date:	Printed Name: Date:
Company:	Company:	Analytical Technologies, Inc.

ATI Labs: San Diego (619)458-9141 • Phoenix (602)438-1530 • Seattle (206)228-8335 • Pensacola (904)474-1001 DISTRIBUTION: White, Canary - ANALYTICAL TECHNOLOGIES, INC. • Pink - ORIGINATOR

Analytical Technologies, Inc.

CLIENT : GEOSCIENCE CONSULTANTS
PROJECT # : C.O.C. 4119
PROJECT NAME : PHILLIPS

DATE RECEIVED : 06/29/91
REPORT DATE : 08/23/91

ATI I.D. : 106993

ATI #	CLIENT DESCRIPTION	MATRIX	DATE COLLECTED
01	9106270820 MW-5	AQUEOUS	06/27/91
02	9106270925 MW-9	AQUEOUS	06/27/91
03	9106271145 WS-2	AQUEOUS	06/27/91
04	9106280900 TRIP BLANK	AQUEOUS	06/28/91

----- TOTALS -----

MATRIX	# SAMPLES
AQUEOUS	4

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of this report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

Analytical Technologies, Inc.

ACCESSION #: 106993

PARAMETER	METHOD	DATE EXTRACTED	DATE ANALYZED	ANALYST
Fuel Hydrocarbons	8015 Mod	07/02/91	07/23/91 07/24/91	D. McKee
BTEX	602	NA	07/08/91 07/09/91	GB, EN, LD

Reference(s): Methods for Chemical Analysis of Water and Wastes
March 1983 EPA-600 4-79-020

SW 846, 3'rd Edition

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10699301

TEST : FUEL HYDROCARBONS (MODIFIED EPA METHOD 8015)

CLIENT	: GEOSCIENCE CONSULTANTS	DATE SAMPLED	: 06/27/91
PROJECT #	: C.O.C. 4119	DATE RECEIVED	: 06/29/91
PROJECT NAME	: PHILLIPS	DATE EXTRACTED	: 07/02/91
CLIENT I.D.	: 9106270820 MW-5	DATE ANALYZED	: 07/23/91
SAMPLE MATRIX	: AQUEOUS	UNITS	: UG/L
		DILUTION FACTOR	: 100

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	31000
HYDROCARBON RANGE	C10-C36
HYDROCARBONS QUANTITATED USING	DIESEL

SURROGATE PERCENT RECOVERIES

DI-N-OCTYL-PHTHALATE (%)	**

** Due to the necessary dilution of the sample, result was not attainable

AnalyticalTechnologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10699302

TEST : FUEL HYDROCARBONS (MODIFIED EPA METHOD 8015)

CLIENT	: GEOSCIENCE CONSULTANTS	DATE SAMPLED	: 06/27/91
PROJECT #	: C.O.C. 4119	DATE RECEIVED	: 06/29/91
PROJECT NAME	: PHILLIPS	DATE EXTRACTED	: 07/02/91
CLIENT I.D.	: 9106270925 MW-9	DATE ANALYZED	: 07/24/91
SAMPLE MATRIX	: AQUEOUS	UNITS	: UG/L
		DILUTION FACTOR	: 2

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	780
HYDROCARBON RANGE	C10-C36+
HYDROCARBONS QUANTITATED USING	DIESEL
SURROGATE PERCENT RECOVERIES	
DI-N-OCTYL-PHTHALATE (%)	103

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10699303

TEST : FUEL HYDROCARBONS (MODIFIED EPA METHOD 8015)

CLIENT	: GEOSCIENCE CONSULTANTS	DATE SAMPLED	: 06/27/91
PROJECT #	: C.O.C. 4119	DATE RECEIVED	: 06/29/91
PROJECT NAME	: PHILLIPS	DATE EXTRACTED	: 07/02/91
CLIENT I.D.	: 9106271145 WS-2	DATE ANALYZED	: 07/24/91
SAMPLE MATRIX	: AQUEOUS	UNITS	: UG/L
		DILUTION FACTOR	: 5

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	1500
HYDROCARBON RANGE	C10-C36
HYDROCARBONS QUANTITATED USING	DIESEL
SURROGATE PERCENT RECOVERIES	
DI-N-OCTYL-PHTHALATE (%)	117

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

REAGENT BLANK

TEST : FUEL HYDROCARBONS (MODIFIED EPA METHOD 8015)

		ATI I.D.	106993
CLIENT	GEOSCIENCE CONSULTANTS	DATE EXTRACTED	07/02/91
PROJECT #	C.O.C. 4119	DATE ANALYZED	07/23/91
PROJECT NAME	PHILLIPS	UNITS	UG/L
CLIENT I.D.	REAGENT BLANK	DILUTION FACTOR	N/A

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	58
HYDROCARBON RANGE	C10-C32
HYDROCARBONS QUANTITATED USING	DIESEL

SURROGATE PERCENT RECOVERIES

DI-N-OCTYL-PHTHALATE (%)	90

Analytical Technologies, Inc.

QUALITY CONTROL DATA

ATI I.D. : 106993

TEST : FUEL HYDROCARBONS (MODIFIED EPA METHOD 8015)

CLIENT : GEOSCIENCE CONSULTANTS
PROJECT # : C.O.C. 4119
PROJECT NAME : PHILLIPS
REF I.D. : 10799828

DATE ANALYZED : 07/24/91
SAMPLE MATRIX :
UNITS : UG/L

COMPOUNDS	SAMPLE RESULT	CONC. SPIKED	SPIKED SAMPLE	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
FUEL HYDROCARBONS	<5	278	389	140	329	118	17

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Spiked Sample Result} - \text{Duplicate Spike Sample Result})}{\text{Average of Spiked Sample}} \times 100$$

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10699301

TEST : BTEX & MTBE (EPA METHOD 8020)

CLIENT	: GEOSCIENCE CONSULTANTS	DATE SAMPLED	: 06/27/91
PROJECT #	: C.O.C. 4119	DATE RECEIVED	: 06/29/91
PROJECT NAME	: PHILLIPS	DATE EXTRACTED	: N/A
CLIENT I.D.	: 9106270820 MW-5	DATE ANALYZED	: 07/09/91
SAMPLE MATRIX	: AQUEOUS	UNITS	: UG/L
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	5000 D
TOLUENE	570 D
ETHYLBENZENE	15
TOTAL XYLENES	88

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE (%)	104

AnalyticalTechnologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10699302

TEST : BTEX & MTBE (EPA METHOD 8020)

CLIENT	: GEOSCIENCE CONSULTANTS	DATE SAMPLED	: 06/27/91
PROJECT #	: C.O.C. 4119	DATE RECEIVED	: 06/29/91
PROJECT NAME	: PHILLIPS	DATE EXTRACTED	: N/A
CLIENT I.D.	: 9106270925 MW-9	DATE ANALYZED	: 07/08/91
SAMPLE MATRIX	: AQUEOUS	UNITS	: UG/L
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	160 D
TOLUENE	56
ETHYLBENZENE	2.5
TOTAL XYLENES	4.2

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE (%)	106

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10699303

TEST : BTEX & MTBE (EPA METHOD 8020)

CLIENT	: GEOSCIENCE CONSULTANTS	DATE SAMPLED	: 06/27/91
PROJECT #	: C.O.C. 4119	DATE RECEIVED	: 06/29/91
PROJECT NAME	: PHILLIPS	DATE EXTRACTED	: N/A
CLIENT I.D.	: 9106271145 WS-2	DATE ANALYZED	: 07/08/91
SAMPLE MATRIX	: AQUEOUS	UNITS	: UG/L
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	280 D
TOLUENE	27
ETHYLBENZENE	1.8
TOTAL XYLENES	2.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE (%)	86

AnalyticalTechnologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

REAGENT BLANK

TEST : BTEX & MTBE (EPA METHOD 8020)

CLIENT	: GEOSCIENCE CONSULTANTS	ATI I.D.	: 106993
PROJECT #	: C.O.C. 4119	DATE EXTRACTED	: 07/08/91
PROJECT NAME	: PHILLIPS	DATE ANALYZED	: 07/08/91
CLIENT I.D.	: REAGENT BLANK	UNITS	: UG/L
		DILUTION FACTOR	: N/A

COMPOUNDS	RESULTS
BENZENE	<1.5
TOLUENE	<1.5
ETHYLBENZENE	<1.5
TOTAL XYLENES	<2.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE (%)	101

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

REAGENT BLANK

TEST : BTEX & MTBE (EPA METHOD 8020)

		ATI I.D.	: 106993
CLIENT	: GEOSCIENCE CONSULTANTS	DATE EXTRACTED	: 07/09/91
PROJECT #	: C.O.C. 4119	DATE ANALYZED	: 07/09/91
PROJECT NAME	: PHILLIPS	UNITS	: UG/L
CLIENT I.D.	: REAGENT BLANK	DILUTION FACTOR	: N/A

COMPOUNDS	RESULTS
BENZENE	<1.5
TOLUENE	<1.5
ETHYLBENZENE	<1.5
TOTAL XYLENES	<2.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE (%)	98

AnalyticalTechnologies, Inc.

QUALITY CONTROL DATA

ATI I.D. : 106993

TEST : BTEX & MTBE (EPA METHOD 8020)

CLIENT : GEOSCIENCE CONSULTANTS
PROJECT # : C.O.C. 4119
PROJECT NAME : PHILLIPS
REF I.D. : 10799830

DATE ANALYZED : 07/09/91
SAMPLE MATRIX :
UNITS : UG/L

COMPOUNDS	SAMPLE RESULT	CONC. SPIKED	SPIKED SAMPLE	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
BENZENE	<0.5	20.0	19.0	95	20.5	103	8
TOLUENE	<0.5	20.0	21.2	106	22.8	114	7
ETHYLBENZENE	NA	NA	NA	NA	NA	NA	NA
TOTAL XYLENES	<0.5	40.0	42.9	107	46.1	115	7

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Spiked Sample Result} - \text{Duplicate Spike Sample Result})}{\text{Average of Spiked Sample}} \times 100$$

GCL **Geoscience Consultants, Ltd.**

☒ Albuquerque
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Suite 250
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(303) 649-9001

☐ Las Cruces
P.O. Drawer MM
Las Cruces, NM 88004
(505) 524-5364

№ 4119

Chain of Custody

DATE 6/28/91 PAGE 1 OF 1

LAB NAME Analytical Technologies, Inc.
ADDRESS 9830 South 51st St., Ste B-113
Phoenix, AZ 85044
TELEPHONE 602/496-4400

SAMPLERS (SIGNATURE) [signature]

ANALYSIS REQUEST

	SAMPLE NUMBER	MATRIX	LOCATION	BASE/NEU/ACID CMPDS. GC/MS/ 625/8270	VOLATILE CMPDS. GC/MS/ 624/8240	PESTICIDES/PCB 608/8080	POLYNUCLEAR AROMATIC 610/8310	PHENOLS, SUB PHENOLS 604/8040	HALOGENATED VOLATILES 601/8010	AROMATIC VOLATILES 602/8020	TOTAL ORGANIC CARBON 415/9060	TOTAL ORGANIC HALIDES 9020	PETROLEUM HYDROCARBONS 418.1	TPH BTEX MODIFIED 8015		PRIORITY POLLUTANT METALS (13)	CAM METALS (18) TTLC/STLC	EP TOX METALS (8)	SDWA-INORGANICS PRIMARY/SECONDARY	HAZARDOUS WASTE PROFILE				NUMBER OF CONTAINERS
1	9106270820	H_2O	MW-5											4										4
2	9106270925	H_2O	MW-9											4										4
3	9106271145	H_2O	WS-2											4										4
4	9106280900	H_2O												1										1

PROJECT INFORMATION

PROJECT: Phillips
PROJECT DIRECTOR M. Nee
CHARGE CODE NO. 528-000
SHIPPING ID. NO. 6664830071
VIA: Fed Ex

SAMPLE RECEIPT

TOTAL NO. OF CONTAINERS	13
CHAIN OF CUSTODY SEALS	Y
REC'D GOOD CONDITION/COLD	Y
CONFORMS TO RECORD	Y

LAB NO. 106993

RELINQUISHED BY 1.	RELINQUISHED BY 2.	RELINQUISHED BY 3.
(Signature) [signature] (Time) 1053	(Signature) (Time)	(Signature) (Time)
(Printed Name) KYLE SUMMERS (Date) 6/28	(Printed Name) (Date)	(Printed Name) (Date)
(Company) GCL	(Company)	(Company)

RECEIVED BY 1.	RECEIVED BY 2.	RECEIVED BY (LABORATORY) 3.
(Signature) (Time)	(Signature) (Time)	(Signature) [signature] (Time) 11:00
(Printed Name) (Date)	(Printed Name) (Date)	(Printed Name) Linda Eshelman (Date) 6/29/91
(Company)	(Company)	ANALYTI

SPECIAL INSTRUCTIONS/COMMENTS:
Detection Limits
TPH - 50ppb
Benzene - 2ppb
Ethylb. 5ppb
Toluene 5ppb
Xylenes 5ppb

DISTRIBUTION: WHITE, CANARY - LABORATORY • PINK - GEOSCIENCE CONSULTANTS, LTD.

(SB

WA

AnalyticalTechnologies,Inc.
Phoenix, Arizona

Chain of Custody

DATE 7/5/91 PAGE 1 OF 1

PROJECT MANAGER: Rebecca Tuboszewski (MMT)

COMPANY: ATI Phoenix
ADDRESS:

BILL TO:
COMPANY:
ADDRESS:

SAMPLERS: (Signature)

PHONE NUMBER ( ) -

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	Petroleum Hydrocarbons (418.1)	(MOD 8015) Gas/Diesel	Diesel/Gasoline/BTXE (MOD 8015/8020)	BTXE (8020) + MTBE	Chlorinated Hydrocarbons (601/8010)	Aromatic Hydrocarbons (602/8020)	MTBE	Pesticides/PCB (608/8080)	Herbicides (615/8150)	Base/Neutral/Acid Compounds GC/MS (625/8270)	Volatile Organics GC/MS (624/8240)	SDWA Primary Standards	SDWA Secondary Standards	SDWA Volatiles (502.1/503.1)	The 13 Priority Pollutant Metals	The 8 EP Tox Metals by EP Tox Prep. (1310)	The 8 EP Tox Metals by Total Digestion	The 8 EP Tox Metals by TCLP (1311)	NUMBER OF CONTAINERS
10699301	6/27/91	0820	H_2O					✓															4
10699302	6/27/91	0925	H_2O					✓															2
10699303	6/27/91	1145	H_2O					✓															2
10699304 trip blank	6/27/91	0000	H_2O					✓															1

PROJECT INFORMATION	
PROJECT NO:	106993
PROJECT NAME:	GCL
P.O. NO.	
SHIPPED VIA:	
SAMPLE DISPOSAL INSTRUCTIONS	☐ ATI ☐ RETURN

SAMPLE RECEIPT	
TOTAL NO. OF CONTAINERS	
CHAIN OF CUSTODY SEALS	
INTACT?	
RECEIVED GOOD COND./COLD	
LAB NUMBER	

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

TAT: (NORMAL) (RUSH) ☐ 24 ☐ 48 ☐ 72 ☐ 1 WEEK

Comments: 10% Client discount
Lab due 7/9/91 Hold Time 7/10 ☆

RELINQUISHED BY: 1.	RELINQUISHED BY: 2.	RELINQUISHED BY: 3.
Signature: Mary M Tyer Time: 3:10	Signature: Time:	Signature: Time:
Printed Name: Mary Tyer Date 7/5/91	Printed Name: Date	Printed Name: Date
Company: ATI	Company:	Company:

RECEIVED BY: 1.	RECEIVED BY: 2.	RECEIVED BY: (LAB) 3.
Signature: Time:	Signature: Time:	Signature: Time:
Printed Name: Date:	Printed Name: Date:	Printed Name: Date:
Company:	Company:	Analytical Technologies, Inc.

Analytical Technologies, Inc.

CLIENT : GEOSCIENCE CONSULTANTS
PROJECT # : C.O.C. 4120
PROJECT NAME : PHILLIPS

DATE RECEIVED : 06/29/91
REPORT DATE : 08/23/91

ATI I.D. : 106994

ATI #	CLIENT DESCRIPTION	MATRIX	DATE COLLECTED
01	9106261325 MW-12	AQUEOUS	06/26/91
02	9106261440 MW-11	AQUEOUS	06/26/91
03	9106261550 MW-13	AQUEOUS	06/26/91
04	9106270615 MW-14	AQUEOUS	06/27/91
05	9106280700 TRIP BLANK	AQUEOUS	06/28/91

----- TOTALS -----

MATRIX	# SAMPLES
AQUEOUS	5

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of this report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

Analytical Technologies, Inc.

ACCESSION #: 106994

PARAMETER	METHOD	DATE EXTRACTED	DATE ANALYZED	ANALYST
Fuel Hydrocarbons	8015 Mod	07/02/90	07/23/91 07/24/91	D. McKee
BTEX	602	NA	07/08/91 07/09/91	EN

Reference(s): Methods for Chemical Analysis of Water and Wastes
March 1983 EPA-600 4-79-020

SW 846, 3'rd Edition

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10699401

TEST : FUEL HYDROCARBONS (MODIFIED EPA METHOD 8015)

CLIENT	: GEOSCIENCE CONSULTANTS	DATE SAMPLED	: 06/26/91
PROJECT #	: C.O.C. 4120	DATE RECEIVED	: 06/29/91
PROJECT NAME	: PHILLIPS	DATE EXTRACTED	: 07/02/91
CLIENT I.D.	: 9106261325 MW-12	DATE ANALYZED	: 07/23/91
SAMPLE MATRIX	: AQUEOUS	UNITS	: UG/L
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	230
HYDROCARBON RANGE	C10-C36+
HYDROCARBONS QUANTITATED USING	DIESEL

SURROGATE PERCENT RECOVERIES

DI-N-OCTYL-PHTHALATE (%)	104

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10699402

TEST : FUEL HYDROCARBONS (MODIFIED EPA METHOD 8015)

CLIENT	: GEOSCIENCE CONSULTANTS	DATE SAMPLED	: 06/26/91
PROJECT #	: C.O.C. 4120	DATE RECEIVED	: 06/29/91
PROJECT NAME	: PHILLIPS	DATE EXTRACTED	: 07/02/91
CLIENT I.D.	: 9106261440 MW-11	DATE ANALYZED	: 07/23/91
SAMPLE MATRIX	: AQUEOUS	UNITS	: UG/L
		DILUTION FACTOR	: 2

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	540
HYDROCARBON RANGE	C10-C36
HYDROCARBONS QUANTITATED USING	DIESEL

SURROGATE PERCENT RECOVERIES

DI-N-OCTYL-PHTHALATE (%)	100

AnalyticalTechnologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10699403

TEST : FUEL HYDROCARBONS (MODIFIED EPA METHOD 8015)

CLIENT	: GEOSCIENCE CONSULTANTS	DATE SAMPLED	: 06/26/91
PROJECT #	: C.O.C. 4120	DATE RECEIVED	: 06/29/91
PROJECT NAME	: PHILLIPS	DATE EXTRACTED	: 07/02/91
CLIENT I.D.	: 9106261550 MW-13	DATE ANALYZED	: 07/23/91
SAMPLE MATRIX	: AQUEOUS	UNITS	: UG/L
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	360
HYDROCARBON RANGE	C10-C36
HYDROCARBONS QUANTITATED USING	DIESEL

SURROGATE PERCENT RECOVERIES

DI-N-OCTYL-PHTHALATE (%)	85

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10699404

TEST : FUEL HYDROCARBONS (MODIFIED EPA METHOD 8015)

CLIENT	: GEOSCIENCE CONSULTANTS	DATE SAMPLED	: 06/27/91
PROJECT #	: C.O.C. 4120	DATE RECEIVED	: 06/29/91
PROJECT NAME	: PHILLIPS	DATE EXTRACTED	: 07/02/91
CLIENT I.D.	: 9106270615 MW-14	DATE ANALYZED	: 07/24/91
SAMPLE MATRIX	: AQUEOUS	UNITS	: UG/L
		DILUTION FACTOR	: 10

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	1200
HYDROCARBON RANGE	C10-C32
HYDROCARBONS QUANTITATED USING	DIESEL

SURROGATE PERCENT RECOVERIES

DI-N-OCTYL-PHTHALATE (%)	106

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

REAGENT BLANK

TEST : FUEL HYDROCARBONS (MODIFIED EPA METHOD 8015)

		ATI I.D.	: 106994
CLIENT	: GEOSCIENCE CONSULTANTS	DATE EXTRACTED	: 07/02/91
PROJECT #	: C.O.C. 4120	DATE ANALYZED	: 07/23/91
PROJECT NAME	: PHILLIPS	UNITS	: UG/L
CLIENT I.D.	: REAGENT BLANK	DILUTION FACTOR	: N/A

COMPOUNDS	RESULTS
FUEL HYDROCARBONS	58
HYDROCARBON RANGE	C10-C32
HYDROCARBONS QUANTITATED USING	DIESEL

SURROGATE PERCENT RECOVERIES

DI-N-OCTYL-PHTHALATE (%)	90

AnalyticalTechnologies, Inc.

QUALITY CONTROL DATA

ATI I.D. : 106994

TEST : FUEL HYDROCARBONS (MODIFIED EPA METHOD 8015)

CLIENT : GEOSCIENCE CONSULTANTS
PROJECT # : C.O.C. 4120
PROJECT NAME : PHILLIPS
REF I.D. : 10799828

DATE ANALYZED : 07/24/91
SAMPLE MATRIX :
UNITS : UG/L

COMPOUNDS	SAMPLE RESULT	CONC. SPIKED	SPIKED SAMPLE	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
FUEL HYDROCARBONS	<5	278	389	140	329	118	17

$$\% \text{ Recovery} = \frac{\text{(Spike Sample Result - Sample Result)}}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{\text{(Spiked Sample Result - Duplicate Spike Sample Result)}}{\text{Average of Spiked Sample}} \times 100$$

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10699401

TEST : BTEX & MTBE (EPA METHOD 8020)

CLIENT	: GEOSCIENCE CONSULTANTS	DATE SAMPLED	: 06/26/91
PROJECT #	: C.O.C. 4120	DATE RECEIVED	: 06/29/91
PROJECT NAME	: PHILLIPS	DATE EXTRACTED	: N/A
CLIENT I.D.	: 9106261325 MW-12	DATE ANALYZED	: 07/08/91
SAMPLE MATRIX	: AQUEOUS	UNITS	: UG/L
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	<1.5
TOLUENE	1.6
ETHYLBENZENE	<1.5
TOTAL XYLENES	<2.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE (%)	95

AnalyticalTechnologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10699402

TEST : BTEX & MTBE (EPA METHOD 8020)

CLIENT	: GEOSCIENCE CONSULTANTS	DATE SAMPLED	: 06/26/91
PROJECT #	: C.O.C. 4120	DATE RECEIVED	: 06/29/91
PROJECT NAME	: PHILLIPS	DATE EXTRACTED	: N/A
CLIENT I.D.	: 9106261440 MW-11	DATE ANALYZED	: 07/08/91
SAMPLE MATRIX	: AQUEOUS	UNITS	: UG/L
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	<1.5
TOLUENE	<1.5
ETHYLBENZENE	<1.5
TOTAL XYLENES	<2.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE (%)	95

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10699403

TEST : BTEX & MTBE (EPA METHOD 8020)

CLIENT	: GEOSCIENCE CONSULTANTS	DATE SAMPLED	: 06/26/91
PROJECT #	: C.O.C. 4120	DATE RECEIVED	: 06/29/91
PROJECT NAME	: PHILLIPS	DATE EXTRACTED	: N/A
CLIENT I.D.	: 9106261550 MW-13	DATE ANALYZED	: 07/08/91
SAMPLE MATRIX	: AQUEOUS	UNITS	: UG/L
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	1.9
TOLUENE	<1.5
ETHYLBENZENE	<1.5
TOTAL XYLENES	<2.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE (%)	97

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10699404

TEST : BTEX & MTBE (EPA METHOD 8020)

CLIENT	: GEOSCIENCE CONSULTANTS	DATE SAMPLED	: 06/27/91
PROJECT #	: C.O.C. 4120	DATE RECEIVED	: 06/29/91
PROJECT NAME	: PHILLIPS	DATE EXTRACTED	: N/A
CLIENT I.D.	: 9106270615 MW-14	DATE ANALYZED	: 07/09/91
SAMPLE MATRIX	: AQUEOUS	UNITS	: UG/L
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	<1.5
TOLUENE	<1.5
ETHYLBENZENE	<1.5
TOTAL XYLENES	<2.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE (%)	100

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

ATI I.D. : 10699405

TEST : BTEX & MTBE (EPA METHOD 8020)

CLIENT	: GEOSCIENCE CONSULTANTS	DATE SAMPLED	: 06/28/91
PROJECT #	: C.O.C. 4120	DATE RECEIVED	: 06/29/91
PROJECT NAME	: PHILLIPS	DATE EXTRACTED	: N/A
CLIENT I.D.	: 9106280700 TRIP BLANK	DATE ANALYZED	: 07/09/91
SAMPLE MATRIX	: AQUEOUS	UNITS	: UG/L
		DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	<1.5
TOLUENE	<1.5
ETHYLBENZENE	<1.5
TOTAL XYLENES	<2.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE (%)	99

Analytical Technologies, Inc.

GAS CHROMATOGRAPHY - RESULTS

REAGENT BLANK

TEST : BTEX & MTBE (EPA METHOD 8020)

		ATI I.D.	: 106994
CLIENT	: GEOSCIENCE CONSULTANTS	DATE EXTRACTED	: 07/08/91
PROJECT #	: C.O.C. 4120	DATE ANALYZED	: 07/08/91
PROJECT NAME	: PHILLIPS	UNITS	: UG/L
CLIENT I.D.	: REAGENT BLANK	DILUTION FACTOR	: N/A

COMPOUNDS	RESULTS
BENZENE	<1.5
TOLUENE	<1.5
ETHYLBENZENE	<1.5
TOTAL XYLENES	<2.5

SURROGATE PERCENT RECOVERIES

BROMOFLUOROBENZENE (%)	101

AnalyticalTechnologies, Inc.

QUALITY CONTROL DATA

ATI I.D. : 106994

TEST : BTEX & MTBE (EPA METHOD 8020)

CLIENT : GEOSCIENCE CONSULTANTS
PROJECT # : C.O.C. 4120
PROJECT NAME : PHILLIPS
REF I.D. : 10799807

DATE ANALYZED : 07/09/91
SAMPLE MATRIX :
UNITS : UG/L

COMPOUNDS	SAMPLE RESULT	CONC. SPIKED	SPIKED SAMPLE	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
BENZENE	<0.5	20.0	19.0	95	20.5	103	8
TOLUENE	<0.5	20.0	21.2	106	22.8	114	7
ETHYLBENZENE	NA	NA	NA	NA	NA	NA	NA
TOTAL XYLENES	<0.5	40.0	42.9	107	46.1	115	7

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Spiked Sample Result} - \text{Duplicate Spike Sample Result})}{\text{Average of Spiked Sample}} \times 100$$

GCL Geoscience Consultants, Ltd.

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500 Copper N.W. Suite 200 Albuquerque, NM 87102 (505) 842-0001	4221 Forbes Blvd., Suite 240 Lanham, MD 20706 (301) 459-9677	13111 E. Briarwood Ave., Suite 250 Englewood, CO 80112 (303) 649-9001	P.O. Drawer MM Las Cruces, NM 88004 (505) 524-5364

№ 4120

Chain of Custody

DATE 6/26/91 PAGE 1 OF ____

LAB NAME Analytical Technologies, Inc.
ADDRESS 9830 South 51st St., Ste B-113
Phoenix, AZ 85044
TELEPHONE 602/496-4400

SAMPLERS (SIGNATURE) [signature]

ANALYSIS REQUEST

	SAMPLE NUMBER	MATRIX	LOCATION	BASE/NEU/ACID CMPDS. GC/MS/ 625/8270	VOLATILE CMPDS. GC/MS/ 624/8240	PESTICIDES/PCB 608/8080	POLYNUCLEAR AROMATIC 610/8310	PHENOLS, SUB PHENOLS 604/8040	HALOGENATED VOLATILES 601/8010	AROMATIC VOLATILES 602/8020	TOTAL ORGANIC CARBON 415/9060	TOTAL ORGANIC HALIDES 9020	PETROLEUM HYDROCARBONS 418.1	TPH BTEX MODIFIED 8015		PRIORITY POLLUTANT METALS (13)	CAM METALS (18) TTLC/STLC	EP TOX METALS (8)	SDWA-INORGANICS PRIMARY/SECONDARY	HAZARDOUS WASTE PROFILE				NUMBER OF CONTAINERS
1	9106261325	WATER	MW-12											4										4
2	9106261440	H_2O	MW-11											4										4
3	9106261550	H_2O	MW-13											4										4
4	9106270615	H_2O	MW-14											4										4
5	9106280700	H_2O												1										1 ~~4~~
																								~~4~~
																								~~4~~
																								~~4~~
																								~~4~~
																								~~4~~

PROJECT INFORMATION

PROJECT: Phillips Lee
PROJECT DIRECTOR: M Nee
CHARGE CODE NO. 528-000
SHIPPING ID. NO. 666483 30060
VIA: Fed EX

SAMPLE RECEIPT

TOTAL NO. OF CONTAINERS	17
CHAIN OF CUSTODY SEALS	Y
REC'D GOOD CONDITION/COLD	Y
CONFORMS TO RECORD	Y

LAB NO. 106994

SPECIAL INSTRUCTIONS/COMMENTS:
Detection limits
TPH-50ppb
Benzene 2ppb
EthyB - 5ppb
Toluene-5ppb
Xylenes-5ppb

RELINQUISHED BY 1.	RELINQUISHED BY 2.	RELINQUISHED BY 3.
[signature] (Signature) 1030 (Time)	(Signature) (Time)	(Signature) (Time)
KYLE SUMMERS (Printed Name) 6/28 (Date)	(Printed Name) (Date)	(Printed Name) (Date)
GCL (Company)	(Company)	(Company)
RECEIVED BY 1.	**RECEIVED BY 2.**	**RECEIVED BY (LABORATORY) 3.**
(Signature) (Time)	(Signature) (Time)	[signature] (Signature) 11:00 (Time)
(Printed Name) (Date)	(Printed Name) (Date)	Linda Eshelman (Printed Name) 6/29/91 Date
(Company)	(Company)	ANALYTI

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(SB

AnalyticalTechnologies,Inc.
Phoenix, Arizona

WA

Chain of Custody

DATE 7/5/91 PAGE 1 OF 1

PROJECT MANAGER: Rebecca Tubaszewski (MT)

COMPANY: ATI Phoenix
ADDRESS:

BILL TO:
COMPANY:
ADDRESS:

SAMPLERS: (Signature)

( ) .
PHONE NUMBER

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB ID
10699401	6/26/91	1325	H_2O	
10699402	6/26/91	1440	H_2O	
10699403	6/26/91	1530	H_2O	
10699404	6/27/91	0615	H_2O	
10699405 trip blank	6/28/91	0700	H_2O	

SAMPLE ID	Petroleum Hydrocarbons (418.1)	(MOD 8015) Gas/Diesel	Diesel/Gasoline/BTXE (MOD 8015/8020)	BTXE (8020) + MTBE	Chlorinated Hydrocarbons (601/8010)	Aromatic Hydrocarbons (602/8020)	MTBE	Pesticides/PCB (608/8080)	Herbicides (615/8150)	Base/Neutral/Acid Compounds GC/MS (625/8270)	Volatile Organics GC/MS (624/8240)	SDWA Primary Standards	SDWA Secondary Standards	SDWA Volatiles (502.1/503.1)	The 13 Priority Pollutant Metals	The 8 EP Tox Metals by EP Tox Prep. (1310)	The 8 EP Tox Metals by Total Digestion	The 8 EP Tox Metals by TCLP (1311)	NUMBER OF CONTAINERS
10699401				✓															2
10699402				✓															2
10699403				✓															2
10699404				✓															2
10699405 trip blank				✓															1

PROJECT INFORMATION	SAMPLE RECEIPT	
PROJECT NO: 106994	TOTAL NO. OF CONTAINERS	
PROJECT NAME: GCL	CHAIN OF CUSTODY SEALS	
P.O. NO.	INTACT?	
SHIPPED VIA:	RECEIVED GOOD COND./COLD	
SAMPLE DISPOSAL INSTRUCTIONS	LAB NUMBER	
☐ ATI ☐ RETURN		

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

TAT: (NORMAL) (RUSH) ☐ 24 ☐ 48 ☐ 72 ☐ 1 WEEK

Comments: 10% Client discount
Lab Due 7/9/91 Hold Time 7/10

RELINQUISHED BY: 1.	RELINQUISHED BY: 2.	RELINQUISHED BY: 3.
Signature: Mary M Tyee Time: 3:12	Signature: Time:	Signature: Time:
Printed Name: Mary Tyee Date 7/5/91	Printed Name: Date	Printed Name: Date
Company: ATI	Company:	Company:

RECEIVED BY: 1.	RECEIVED BY: 2.	RECEIVED BY: (LAB) 3.
Signature: Time:	Signature: Time:	Signature: Time:
Printed Name: Date:	Printed Name: Date:	Printed Name: Date:
Company:	Company:	Analytical Technologies, Inc.

APPENDIX B

Appendix B

ATI Correspondence

Analytical Technologies, Inc. 9830 S. 51st Street Suite B-113 Phoenix, AZ 85044 (602) 496-4400

Accession: 106982

August 22, 1991

Geoscience Consultants
500 Copper NW
Suite 200
Albuquerque, NM 87102

Project Name/Number: Phillips / C.O.C. 4121

Attention: Martin Nee

On 06/29/91 Analytical Technologies, Inc. received a request to analyze aqueous samples for Total Petroleum Hydrocarbons (TPH) by method 8015, Modified, and BTEX. A special detection limit of 50 ppb was requested for TPH analyses. The results of these analyses and the quality control data, which follow each set of analyses, are enclosed.

For aqueous samples, the ATI detection limit for method 8015, modified, is 5000 ug/l. In order to reach the specified detection limit, ATI used the TPH method outlined in the California Dept. of Health Services LUFT manual. A copy of this method is enclosed. The procedure for this method involves extracting the petroleum hydrocarbons from the sample with a solvent (ATI uses methylene chloride) and condensing the extract with a Kuderna-Danish apparatus. The extract is then analyzed by a Gas Chromatograph equipped with a Flame Ionization Detector. When analyzing TPH by this method light end hydrocarbons (C5-C8) are usually lost during the solvent concentration procedure.

ATI can analyze for Total Volatile Hydrocarbons and BTEX with a 50 ppb detection limit by using Method 8020/8015. This Method will not detect hydrocarbons heavier than C12. If, in the future, you require only light end hydrocarbons please request Total Volatile Hydrocarbons.

If you have any question, please do not hesitate to contact us at (602) 496-4400.

Mary G. Tyer

Mary Tyer
Project Manager

Enclosure

MT/jat

APPENDIX C

SAMPLE COLLECTION, TRANSPORT, AND LABORATORY ANALYSES

A. Sample Collection

1. Field Notebook

The field investigator should keep a field notebook (preferably bound with pages numbered) to record sample collection procedures, dates, laboratory identification, sample collection location, and the name of the sampler. This is important for later recall or legal challenge.

2. Soil Samples

a. Hydrocarbons: Soil samples collected from a backhoe, the ground or a soil coring device, should be collected in a thin-walled stainless steel or brass cylinder at least three inches long by one inch in diameter that has been prepared by the laboratory doing the analysis or the project consultant (cylinders can be made to fit inside the preferred split-barrel core sampler). About one inch of soil should be removed from the immediate surface area where the sample is to be taken and the cylinder then pounded into the soil with a wooden mallet. No headspace should be present in the cylinder once the sample is collected. When the sample is collected, each end of the cylinder should be covered with aluminum foil and then capped with a polyethylene lid, taped, and labeled. The sample should then be immediately placed in an ice chest containing dry ice and kept frozen for delivery to the laboratory. Care should be taken throughout to avoid contamination of both the inside and outside of the cylinder and its contents (1).

Samples should be kept frozen at the laboratory until they are analyzed. Holding time should not exceed 14 days from the time of collection. Frozen soil cores should be removed from the cylinders by spot heating the cylinder and immediately extruding the sample (or a portion of it). A portion of the frozen sample should be removed and prepared for analysis according to approved EPA methods.

In situations where the above procedure is inappropriate, i.e. semi-solid samples, glass vials (properly prepared by contract laboratory or consultant) with Teflon seal and screw cap should be used, and maintained at 4°C until analysis.

b. Organic lead: Tetraethyl/tetramethyl-lead are volatile; therefore, soil samples should be collected in cylinders and frozen as described for volatile hydrocarbons above.

c. Shipping Samples: Where commercial shippers are involved, dry ice may present Department of Transportation (DOT) shipping problems and "blue ice" may have to be substituted.

3. Water Samples

a. Free floating product (from a well): Sampling of free floating product on the surface of ground water should not be performed until the well has been allowed to stabilize for at least 24 hours after development or other withdrawal procedure. A sample should be collected that is indicative of the thickness of floating product within the monitoring well. This may be accomplished by the use of a clear, acrylic bailer designed to collect a liquid sample where free product and ground water meet. A graduated scale on the bailer is helpful for determining the thickness of free product. Samples should be field-inspected for the presence of odor and/or sheen in addition to the above evaluation.

Electronic measuring devices also are available for determining the thickness of the hydrocarbon layer floating on ground water.

b. Dissolved product (from a well): If free product is detected, analysis of water for dissolved product should be conducted after the free product has been substantially removed from the well. Before collecting a water sample, a well should be purged until temperature, conductivity and pH stabilize. Often, this will require removal of four or more well volumes by bailing or pumping. Once well volumes are removed and well water is stabilized, a sample can be taken after the water level approaches 80 percent of its initial level. Where water level recovery is slow, the sample can be collected after stabilization is achieved.

Ground water samples should be collected in a manner which reduces or eliminates the possibility of loss of volatile constituents from the sample. For collecting samples, a gas-actuated positive displacement pump or a submersible pump is preferred. A Teflon or stainless steel bailer is acceptable. Peristaltic pumps or airlift pumps should not be used.

Cross-contamination from transferring pumps (or bailers) from well to well can occur and should be avoided by thorough cleaning between sampling episodes. Dedicated (i.e., permanent installation) well pumps, while expensive, are often cost effective in the long term and ensure data reliability relative to cross-contamination. If transfer of equipment is necessary, sampling should proceed from the least contaminated to the most contaminated well, if the latter information is available before sample collection.

Water samples should be collected in vials or containers specifically designed to prevent loss of volatile constituents from the sample. These vials should be provided by an analytical laboratory, and preferably, the laboratory conducting the analysis. No headspace should be present in the sample container once the container has been capped. This can be checked by inverting the bottle, once the sample is collected, and looking for bubbles. Sometimes it is not possible to collect a sample without air bubbles, particularly if water is aerated. In these cases, the investigator should record the problem and account for probable error. Cooling samples may also produce headspace (bubbles), but these will disappear once the sample is warmed for analysis.

Samples should be placed in an ice chest maintained at 4°C with blue ice (care should be taken to prevent freezing of the water and bursting of the glass vial). A thermometer with a protected bulb should be carried in each ice chest.

c. Surface water: Grab samples should be collected in appropriate glass containers supplied by the laboratory. The sample should be collected in such a manner that air bubbles are not entrapped. Semisolid samples should be collected the same way. The collected samples should be refrigerated (blue ice, 4°C) for transport and analyzed within 7 days of collection (14 days with preservatives).

B. Guidelines for Handling Samples (Presented in Tables 3-2 and 3-3)

TABLE 3-2

REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES FOR WATER SAMPLES 1/

Test	Container 2/	Preservation	Maximum Holding Time 3/
Purgeable aromatic hydrocarbons (BTX&E) Method 8020 or 602	G, Teflon-lined septum	Cool, 4°C, 0.008% Na2S203 4/ HCl to pH2 5/	Analyze within 7 days (max. 14 days with preservative)
Total petroleum hydrocarbons as gasoline	G	Cool, 4°C 0.008% Na2S203 4/ HCl to pH2 5/	Analyze as soon as possible (max. 14 days)
Total petroleum hydrocarbons -- diesel fuel oil	G	Cool, 4°C	14 days; analyze extract within 40 days

1/ Modified from 40 Code of Federal Regulations (CFR), Part 136, Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act.

2/ Glass (G).

3/ Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still be considered valid. Samples may be held for a longer period only if the collector or laboratory has data on file to show that the specific types of samples under study are stable for the longer time. Some samples may not be stable for the maximum time period given in the table.

4/ Should only be used in the presence of residual chlorine.

5/ Sample receiving no pH adjustment must be analyzed within seven days of sampling. Sample vials containing hydrochloric acid (HCL) as a preservative should be handled with caution to avoid eye and skin contact.

TABLE 3-3

HOLDING TIME FOR SOIL SAMPLES 1/

Analyte	Holding Time for Soil
Benzene, toluene, xylenes	Analyze as soon as possible (maximum 14 days)
Total Petroleum Hydrocarbons, as gasoline	Analyze as soon as possible (maximum 14 days)
Total Petroleum Hydrocarbons, as diesel	Extract within 14 days, analyze extract within 40 days

1/ Results from samples not meeting the listed holding times should be considered minimum values. That is, the actual concentration is equal to or greater than the concentration determined after the holding time has expired.

C. Analytical Methods

Table 3-4 (page 65) summarizes common analytical procedures for soil and water analysis of fuel products. The Department of Health Services may approve an alternate analytical method which has at least equivalent detection limits, precision, and accuracy as the referenced methods. For example, a cyrogenic gas chromatography/mass spectrometry (GC/MS) system may be used instead of a gas chromatography (GC) system, provided that the GC/MS system can produce data which are equal to or better than data provided by the referenced GC system in terms of detection limits, precision and accuracy for an identical sample matrix.

Total Petroleum Hydrocarbons (TPH) arising from gasoline or diesel and total organic lead can be analyzed by the attached Department of Health Services (DHS) methods. The investigator should alert the laboratories to the procedures given in Table 3-4 and supply the laboratories with copies of the TPH and total organic lead methods, if necessary.

TABLE 3-4
SUMMARY OF ANALYTICAL PROCEDURES

Substance to be Analyzed	Analytical Method 3/	Reference
1. Gasoline:		
a. Benzene, toluene, xylene, ethylbenzene (aromatic volatile organics)	EPA 8020 (soil)	2
	EPA 602 (water)	3,5
b. Total Petroleum Hydrocarbons	DHS (recommended procedure)	See attached method
c. Halogenated volatile organics, including 1,2-dibromoethane (EDB) 1,2-dichloroethane (EDC)	EPA 8010 (soil)	2
	EPA 601 (water)	3,5
EDB	DHS extraction method 1/	6
2. Diesel:		
a. Total Petroleum Hydrocarbons	DHS (recommended procedure)	See attached method
b. Total Recoverable Petroleum Hydrocarbons (TRPH) 2/	EPA 418.1	4
3. Organic lead:	DHS	See attached DHS method
4. Ignitability: Flash Point	EPA 1010, 1020	2

1/ This is a liquid/liquid extraction procedure for water samples. The method was developed by DHS and provides a means for detecting EDB at a lower concentration (parts per trillion) than does EPA method 8010 (parts per billion). The procedure was developed to detect EDB in ground water as part of the AB 1803 program.

2/ This is a relatively quick analytical procedure that measures recoverable petroleum hydrocarbons, including oil and grease. It is applicable for measuring light fuel fractions, but loses approximately half of any gasoline present (ref. 4). The method costs less than the recommended procedure and is useful primarily as a survey tool.

3/ Other analytical methods are available, for example, some laboratories use a modified EPA method 8015 that detects volatile, non-halogenated hydrocarbons for TPH analysis. The investigator should check with the laboratory (or consultant) to ensure that the analytical method used will provide acceptable data.

Detection Limits for LUFT Investigations

Minimum detection limits for key analytes are listed in Table 3-5 below. The detection limits for benzene, toluene, and xylene are consistent with the experience of several commercial laboratories under optimal conditions. The detection limits for benzene, toluene, and xylene in soil assume the direct purging of a soil-water mixture and subsequent gas chromatography -photoionization detection (GC-PID). Lower detection limits are achievable with available technology by using: modifications of reference methods, a larger sample or additional concentration techniques. Detection limits may be significantly higher in samples with interfering organics or matrix effects. The readily obtainable 0.3 ppm detection limit cited on page 20 takes into account potential sample interferences.

TABLE 3-5

DETECTION LIMITS FOR COMMONLY ANALYZED FUEL PRODUCTS

Analyte	Water µg/l	Soil µg/kg	Method
Benzene	0.3	5	EPA 602, 8020
Toluene	0.3	5	EPA 602, 8020
Xylenes, total	0.6	15	EPA 602, 8020
Total Petroleum Hydrocarbons	500.0	10,000	DHS: GC-FID

D. Recommended DHS Analytical Methods

Total Petroleum Hydrocarbons (TPH) Analysis -- Gasoline and Diesel

1. Scope and Application

   a. This method is for the determination of gasoline and diesel in contaminated ground water, sludges, and soil.

   b. This method is recommended for use by, or under the supervision of, analysts experienced in the operation of GC and in the interpretation of chromatograms.

2. Summary of Method

a. This method involves the determination of volatile hydrocarbons (gasoline) by the headspace method (EPA 5020) or the purge and trap method (EPA 5030) (2) and the determination of semivolatile organics (diesel) by the extraction method. A sample, after headspace, purge and trap, or extraction treatment, is injected into a GC, and compounds in the GC effluent are detected by an FID. Blanks, duplicates and spikes must be analyzed at a minimum of once for every batch of samples (5) or each type of matrix or every 20 samples whichever is more frequent.

b. The sensitivity of this method usually depends on the level of interference rather than on instrument limitations. Table 3-6 below lists the limits of detection established by the Department of Health Services in the absence of interferences for water and soil samples.

TABLE 3-6

TPH METHOD DETECTION LIMITS

Parameter	Matrix	Extraction Method	Headspace Method
Gasoline	Aqueous	0.5 mg/l	5.0 mg/l
	Soil	10.0 mg/kg	5.0 mg/kg
Diesel	Aqueous	0.5 mg/l	
	Soil	10.0 mg/kg	

3. Interferences

a. Solvents, reagents, glassware, and other sample-processing hardware must be demonstrated to be free from interferences under the conditions of the analysis by running method blanks.

b. Before processing any samples, the analyst should demonstrate daily, through the analysis of a solvent blank, that the entire system is interference-free.

4. Apparatus and Materials

a. Gas-tight syringe: One cubic centimeter (cc) with chromatographic needles.

b. Vial with cap: 40 milliliter (ml) capacity screw cap (Pierce number 13075 or equivalent). Detergent wash, rinse with tap and distilled deionized water, and dry at 105°C before use.

c. Septum: Teflon-faced silicone (Pierce number 12722 or equivalent). Detergent wash, rinse with tap and distilled deionized water, and dry at 105°C for 30 minutes before use.

d. Separatory funnel: 2-liter with Teflon stopcock.

e. Kuderna-Danish (K-D) apparatus.

f. Boiling chips: Solvent extracted approximately 10/40 mesh.

g. Water bath: Heated, with concentric ring cover, capable of temperature control. The bath should be used in a hood.

h. GC: Analytical system complete with programmable GC suitable for on-column injection and all required accessories, including FID, column supplies, recorder, and gases. A data system for measuring peak area is recommended.

i. GC column: 6 feet by 1/8 inch ID glass column packed with 5% SP-2100 on Supelcoport 60/80 mesh.

j. Detector: FID.

k. Microsyringes: 10 µl, 100 µl, 200 µl.

l. Erlenmeyer flask: Pyrex, 250 ml capacity with a screw cap.

m. Mechanical shaker.

5. Reagents

a. Stock diesel standard solutions: Prepare a commercial diesel standard in carbon disulfide. Place 9 ml of CS_2 into a 10 ml glass-stoppered volumetric flask. Allow to stand for a few minutes. Weigh the flask to the nearest 0.1 mg. Using a 100 µl syringe, immediately add an amount of diesel to the flask, then reweigh. Be sure that the liquid falls directly into the CS_2 without contacting the neck of the flask. Dilute to volume, stopper, mix by inverting the flask several times. Calculate the concentration in µg/l from the net gain in weight. Secondary working standards can be prepared from the stock standards.

b. Stock gasoline standard solutions: Gasoline stock standards can be prepared as above using commercial gasoline as standard in dodecane.

c. Sodium sulfate, anhydrous, ACS, granular.

d. Carbon disulfide, glass distilled, high purity. Another solvent such as ethyl acetate or methylene chloride may be used provided that the solvent can extract the petroleum hydrocarbons and does not interfere with the resulting gas chromatogram of the TPH. This must be demonstrated by spike and recovery prior to the analysis of samples.

e. Dodecane, purified.

6. Procedures

a. Organic Liquid

Organic liquid can be analyzed by dissolving a known amount of sample into a certain volume of carbon disulfide in a volumetric flask.

b. Water

(1) Transfer one liter of sample to the two liter separatory funnel.

(2) Add 60 ml of solvent to the separatory funnel.

(3) Seal and shake the funnel for 60 seconds with periodic venting to release vapor pressure.

(4) Allow the phases to separate for minimum of 10 minutes. If emulsion occurs, the analyst must employ mechanical techniques to complete the phase separation.

(5) Collect the extract and repeat the extraction two more times using fresh portions of solvent.

(6) Combine three extracts and dry by passing through a column of anhydrous sodium sulfate.

(7) Collect the dried extract in a K-D evaporative concentrator equipped with a 10 ml collection ampule.

(8) Add one or two clean boiling chips to the flask and attach a three-ball Snyder column. Prewet the Snyder

column by adding 1 ml of solvent to the top. Place the K-D apparatus on a steam or hot-water bath. Adjust the water temperature as required to complete the concentration in 15 to 20 minutes. When the volume of liquid reaches 1 ml, remove the K-D apparatus and allow it to drain for at least 10 minutes while cooling.

(9) Rinse the K-D apparatus with a small volume of solvent. Adjust the sample volume to 5 ml with the solvent to be used in instrument analyses.

c. Soil and Sludges

(1) Weigh 20.0 gram (g) sample into a 250 ml screw cap Erlenmeyer flask. Add 80 ml of solvent.

(2) Cap the flask and shake on a mechanical shaker for at least four hours.

(3) After the extraction is completed, filter the extract and dry it by passing through a column of anhydrous sodium sulfate.

(4) Collect the dried extract in K-D flask, fitted with a 10 ml concentrator tube and a three-ball Snyder column. Wash the extractor flask and the sodium sulfate with a portion of carbon disulfide and collect it into the K-D flask.

(5) Add one or two clean boiling chips and concentrate the extract to 5 ml as discussed in steps (8) and (9) above.

d. GC Conditions

The recommended GC column and operating conditions are:

Column: 6 feet by 1/8 inch ID glass column packed with 5% SP-2100 on Supelcoport, 60/80 mesh with nitrogen carrier gas at 20 ml/minute flow rate. Column temperature is set at 40°C at the time of injection, hold for 4 minutes, and programmed at 10°C/minute to a final temperature of 265°C for 10 minutes.

e. Calibration

(1) Establish GC operating parameters as specified in d. above. By injecting secondary standards, adjust the sensitivity of the analytical system for the analysis of gasoline and diesel in environmental samples. Detection limits for the extraction method and the

headspace method are listed in Table 3-6 (page 67). Calibrate the chromatographic system with the external standard technique. At least three concentration levels should be used for the preparation of the calibration curve. One of the external standards should be at a concentration near, but above, the method detection limit. The other standard should correspond to the expected range of concentrations found in real samples or should define the working range of the detector.

(2) Using injections of 2 to 5 μl of each calibration standard, tabulate total peak height or area responses against the mass injected. The results can be used to prepare a calibration curve for gasoline and diesel.

(3) The working calibration curve must be verified on each working day by the measurement of one or more calibration standards. If the response varies from the predicted response by more than ten percent, the test must be repeated using a fresh calibration standard. Alternatively, a new calibration curve must be prepared.

f. Analysis of Samples

(1) Extract

(a) Inject 2 to 5 μl of the sample extract using the solvent flush technique. Record the volume injected to the nearest 0.05 μl, and the resulting total peak areas.

(b) If the total peak areas exceed the linear range of the system, dilute the extract and reanalyze.

(2) Headspace Method [Note: Purge and trap (EPA 5030) may be used instead of headspace.]

(a) Place 20 g (ml) each of the waste sample into three separate 40 ml septum seal vials.

(b) Inject into one sample vial through the septum 200 μl of the gasoline standard in dodecane (concentration 7,500 μg/ml). Label this "spike".

(c) Inject into a separate (empty) 40 ml septum seal vial 200 μl of the same standard. Label this "standard".

(d) Place the sample, spike, and standard vials into a 90°C water bath for one hour. Store the remaining sample vial at 4°C for possible future analysis.

(e) While maintaining the vials at 90°C, withdraw 1 ml of the headspace gas with a gas-tight syringe and analyze by injecting into a GC.

(f) Analyze the standard and adjust instrument sensitivity to give minimum response of at least two times the background. Record and sum up all peak areas of the gasoline standard.

(g) Analyze the spike sample in the same manner. Record all peak areas.

(h) Analyze the undosed sample as in (g) above.

(i) Small sample size should be used if the concentration is found to be outside the concentration range of the instrument.

g. Standard laboratory quality control practices should be used with this method.

Determination of Organic Lead -- DHS Method

1. Discussion

Organic lead compounds constitute the largest single industrial application of organo-metallic chemistry. Estimates indicate that about 1,450 organic lead compounds were known in 1968, and the number has increased with synthesis of about 130 new compounds each year. The widespread presence of toxic, volatile, lipophilic organic lead compounds in the environment can lead to serious public health effects and damage to the aquatic biota. With the phasing out of leaded fuels, substantial amounts of lead compounds from petroleum sludges are being discharged into waste streams. There is also evidence to suggest that the more toxic organic leads such as tetramethyl-lead can be synthesized from lead salts and simple chemical reagents in aqueous solutions.

Caution: Some organic lead compounds are volatile and toxic. Process the samples in a well-ventilated hood.

2. Scope

The method describes the determination of organic lead compounds in various types of hazardous material samples. In this method, a rapid organic extraction technique is applied to separate the organic lead from a matrix with xylene, followed by reaction with

1% Aliquat 336/MIBK on I_2 solution. The extract is then analyzed by a flame atomic absorption spectrophotometer. The detection limit for organic lead is: soil 0.5 mg/kg; water 0.1 mg/l.

3. Reagents

3.1 (MIBK) methyl-isobutyl ketone (4-methyl-2-pentanone).

3.2 Iodine solution: Weigh 3.0 g of I_2 and dissolve and dilute to 100 ml with benzene. Store in brown bottle.

3.3 Aliquat 336 (tri-capryl methyl ammonium chloride), available from McKesson Company, Minneapolis, Minnesota.

10% V/V Aliquat 336/MIBK
1% V/V Aliquat 336/MIBK

3.4 Xylene.

3.5 $PbCl_2$ -- Lead chloride

1. Stock $PbCl_2$ solution. Dissolve 0.3356 g $PbCl_2$ previously dried at 105°C for 3 hours in 10% Aliquat 336 in MIBK solution and dilute to 250 ml. Store in brown bottle. This solution contains 1,000 µg/ml of Pb.

2. Preparation of intermediate Pb standard: Pipet 10 ml of the stock solution (1,000 µg/ml Pb) and dilute to 100 ml with xylene/MIBK solution (40% xylene).

3.6 Sodium sulfate (Na_2SO_4), anhydrous, crystals.

4. Apparatus

4.1 Erlenmeyer flask with ground glass stopper, 250 ml.

4.2 Mechanical shaker.

4.3 Filter funnel and paper (Whatman No. 40 or equivalent).

4.4 Flame atomic absorption spectrophotometer and recorder or integrator.

4.5 Lead hollow cathode or electrodeless discharge lamp.

5. Procedure

5.1 Sludges, sediments, and soils: Weigh out to the nearest 0.1 g about 50 g of homogenized sample into an Erlenmeyer flask. Add 100 ml xylene. Stopper the flask and shake it for 1/2 hour on a mechanical shaker. Filter the extract through filter paper and anhydrous sodium sulfate.

5.2 Add 20 ml of MIBK to a 50 ml volumetric flask.

5.3 Pipet 20.0 ml of the xylene extract (Step 5.1) into the flask and mix.

5.4 Pipet 0.1 ml of I_2 solution into the flask and mix for about one minute.

5.5 Pipet 5 ml of 1% Aliquat 336 in MIBK and mix.

5.6 Dilute to volume with MIBK and mix.

6. Standard and Blank Preparation

Prepare appropriate working standards and blank from 100 μg/ml Pb standard.

6.1 Add approximately 20 ml of xylene to 50 ml volumetric flask. Pipet the correct amount of the 100 μg/ml Pb standard into the flask to prepare the right standard.

6.2 Add immediately 0.1 ml of I_2 solution and mix well.

6.3 Add 5 ml of 1% Aliquat 336/MIBK and mix well.

6.4 Dilute to volume with MIBK and mix well.

6.5 Blank xylene/MIBK (40% xylene) should be treated as the working standard solutions.

7. Analysis

7.1 Set up the AA according to the manufacturer's instructions. Use background correction to decrease broad band absorption interference.

7.2 Aspirate H_2O into the flame and adjust the acetylene flow to 8.5 l/min and the air flow to 25 l/min.

7.3 Aspirate MIBK containing 40% xylene into the flame.

7.4 Reduce the acetylene flow to about 4.8 l/min and make fine adjustments in the acetylene flow to produce an even flame with no yellow luminescence to obtain optimum conditions.

7.5 Aspirate into the flame blank, working standards, and sample to measure the absorbencies. Estimate the concentrations of organic lead in sample.

8. Calculations

Solids:

$$\frac{100\ ml}{50g} \times \frac{50\ ml}{20\ ml} \times \frac{\mu g/l}{1000\ ml/l} \times F = \mu g/g \text{ organic lead calculated as Pb.}$$

where F = dilution factor. .

E. Quality Assurance (QA) and Quality Control (QC)

1. Definition

Quality Assurance: Systematic procedures that are used to provide assurance to a producer or user of information that defined standards of quality were met. QA covers field and laboratory performance, i.e., the quality control procedures that have been followed.

Quality Control: The activities that are used to implement the quality assurance plan. Quality includes adequacy of the methods employed, reliability of the results, and cost effectiveness.

2. Chain of Custody

A Chain of Custody Record is the disposition of a sample from collection to laboratory delivery. A Chain of Custody Record should be made out after samples are collected and signed by individuals collecting, relinquishing, and receiving samples. See Figure III-6 (page 78) for an example of a U. S. EPA Chain of Custody form.

3. Laboratory Certification

All soil and water samples should be analyzed by a DHS-certified laboratory. Two certification programs exist in California and both are administered by DHS. Additional information can be obtained from the addresses listed:

- Hazardous Materials Laboratory Certification Program

  California Department of Health Services
  Hazardous Materials Laboratory
  2151 Berkeley Way, Room 234
  Berkeley, CA 94704
  (415) 540-3003

- Drinking Water Laboratory Certification

  California Department of Health Services
  Sanitation and Radiation Laboratory
  2151 Berkeley Way, Room 465
  Berkeley, CA 94704
  (415) 540-2201

4. QA Project Plan: This is a plan that outlines objectives, operational procedures, and the means for assuring how data of known and acceptable quality can be obtained. Where major projects are involved in remedial action, a plan for a performance audit (field and laboratory operations) and corrective action may be needed.

5. Number of Samples to Collect: The number of samples required relates directly to project objectives and the level of data reliability desired. The following are minimal recommendations and do not ensure that representative or statistically valid sampling of a site has been achieved.

   - Soil -- Tank excavation hole: At least two samples collected immediately after the tank is removed. This number should be increased for more accurate representation in very large excavations.

   - Soil background: Average of three samples.

   - Soil: Where >10 samples are to be collected at the same site, five percent duplicates should be collected and analyzed.

   - Water: Volatile organic analysis (VOA): All VOA samples should be collected in duplicate. One sample should be analyzed. The other acts as a backup in case a vial is broken or re-analysis is necessary.

   - Water: Non-VOA analysis (.5-1-liter volume): One sample.

   - QC for remedial action should be designed to meet cleanup/closure objectives for the particular site. The basic principles outlined should be applied.

   A general guide for field QC samples is presented in Table 3-7 (page 79).

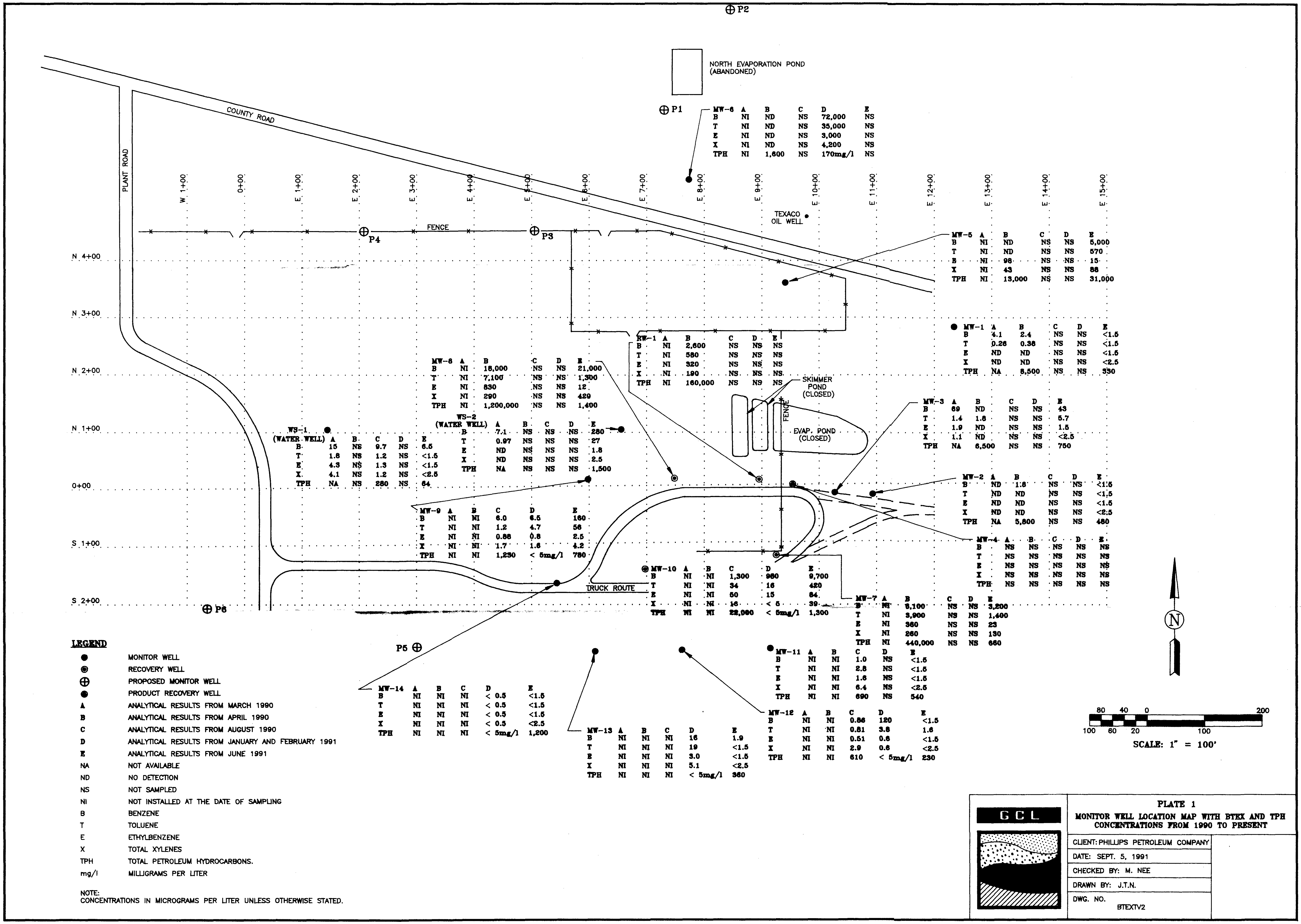
6. Special Split-Sample Collection Instructions (7)

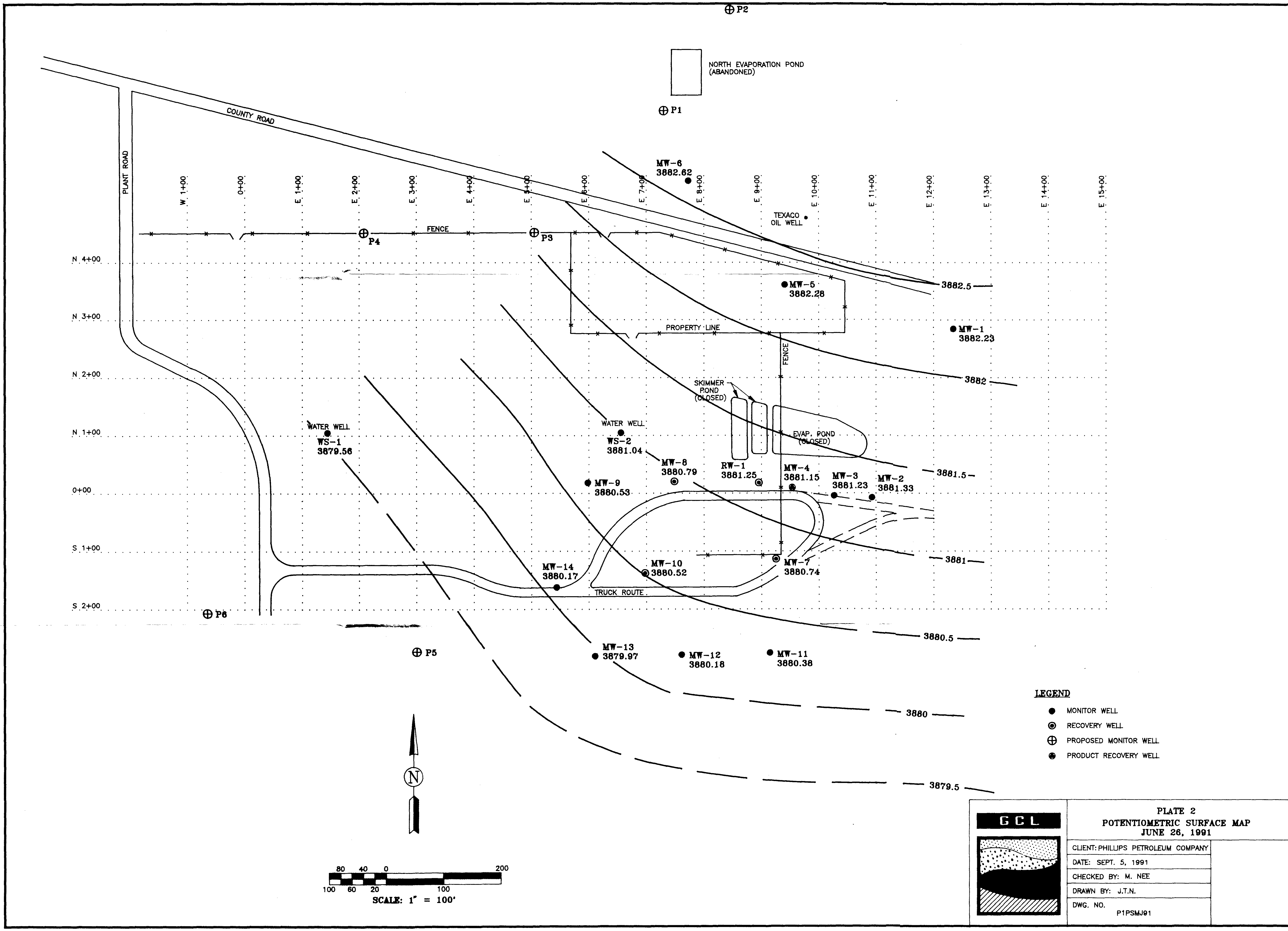
   a. Purgeable organics or VOAs: Individual samples are taken rapidly in succession in the specified containers. The individual samples may then be analyzed in replicate. With the exception of samples collected in a bailer, VOA splits should not be collected by pouring from one container into another.

b. Nonvolatile hydrophobic organics (e.g., PCBs): Due to the hydrophobic character of these compounds, it is not practical to split an aqueous sample. Consequently, it is recommended that replicates be run on the extract only. That is, when the analytical procedure for a hydrophobic organic is followed, the extract should be carried through in replicate through the column chromatography and analytical determinations.

c. Other analyses: Samples are split into portions while the original sample container is agitated.

d. Metals, except chromium VI and dissolved metals: When splitting samples for metal analyses, the sample must be acidified with nitric acid to pH <2 before dividing the sample. Acidification is especially critical if the sample is basic, in order to prevent precipitation of metallic hydroxides.

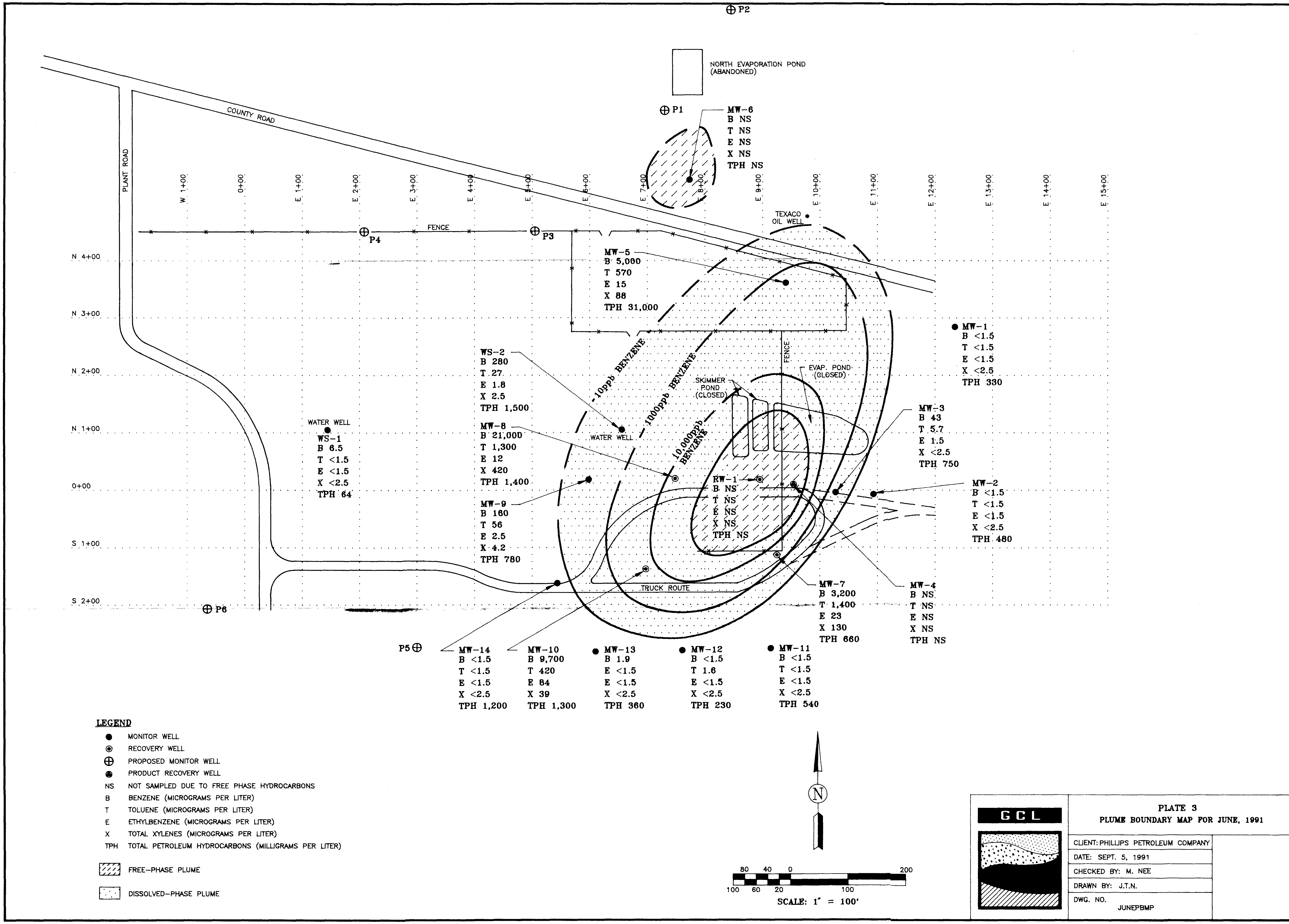

P2
NORTH EVAPORATION POND (ABANDONED)
P1
COUNTY ROAD
PLANT ROAD
MW-6 A B C D E
B NI ND NS 72,000 NS
T NI ND NS 35,000 NS
E NI ND NS 3,000 NS
X NI ND NS 4,200 NS
TPH NI 1,600 NS 170mg/l NS
W 1+00
0+00
E 1+00
E 2+00
E 3+00
E 4+00
E 5+00
E 6+00
E 7+00
E 8+00
E 9+00
E 10+00
E 11+00
E 12+00
E 13+00
E 14+00
E 15+00
TEXACO OIL WELL
FENCE
P4
P3
N 4+00
N 3+00
N 2+00
N 1+00
0+00
S 1+00
S 2+00
MW-5 A B C D E
B NI ND NS NS 5,000
T NI ND NS NS 570
E NI 98 NS NS 15
X NI 43 NS NS 88
TPH NI 13,000 NS NS 31,000
MW-1 A B C D E
B 4.1 2.4 NS NS <1.5
T 0.26 0.36 NS NS <1.5
E ND ND NS NS <1.5
X ND ND NS NS <2.5
TPH NA 8,500 NS NS 330
RW-1 A B C D E
B NI 2,600 NS NS NS
T NI 580 NS NS NS
E NI 320 NS NS NS
X NI 190 NS NS NS
TPH NI 160,000 NS NS NS
MW-8 A B C D E
B NI 16,000 NS NS 21,000
T NI 7,100 NS NS 1,300
E NI 830 NS NS 12
X NI 290 NS NS 429
TPH NI 1,200,000 NS NS 1,400
SKIMMER POND (CLOSED)
FENCE
EVAP. POND (CLOSED)
MW-3 A B C D E
B 69 ND NS NS 43
T 1.4 1.8 NS NS 5.7
E 1.9 ND NS NS 1.5
X 1.1 ND NS NS <2.5
TPH NA 6,500 NS NS 750
WS-2 (WATER WELL) A B C D E
B 7.1 NS NS NS 280
T 0.97 NS NS NS 27
E ND NS NS NS 1.8
X ND NS NS NS 2.5
TPH NA NS NS NS 1,500
WS-1 (WATER WELL) A B C D E
B 15 NS 9.7 NS 6.5
T 1.8 NS 1.2 NS <1.5
E 4.3 NS 1.3 NS <1.5
X 4.1 NS 1.2 NS <2.5
TPH NA NS 280 NS 64
MW-2 A B C D E
B ND 1.8 NS NS <1.5
T ND ND NS NS <1.5
E ND ND NS NS <1.5
X ND ND NS NS <2.5
TPH NA 5,800 NS NS 480
MW-9 A B C D E
B NI NI 6.0 6.5 160
T NI NI 1.2 4.7 56
E NI NI 0.88 0.8 2.5
X NI NI 1.7 1.6 4.2
TPH NI NI 1,230 < 5mg/l 780
MW-4 A B C D E
B NS NS NS NS NS
T NS NS NS NS NS
E NS NS NS NS NS
X NS NS NS NS NS
TPH NS NS NS NS NS
MW-10 A B C D E
B NI NI 1,300 980 9,700
T NI NI 34 16 420
E NI NI 60 15 84
X NI NI 16 < 5 39
TPH NI NI 22,000 < 5mg/l 1,300
TRUCK ROUTE
MW-7 A B C D E
B NI 5,100 NS NS 3,200
T NI 3,900 NS NS 1,400
E NI 360 NS NS 23
X NI 260 NS NS 130
TPH NI 440,000 NS NS 660
P6
P5
MW-11 A B C D E
B NI NI 1.0 NS <1.5
T NI NI 2.8 NS <1.5
E NI NI 1.6 NS <1.5
X NI NI 6.4 NS <2.5
TPH NI NI 690 NS 540
MW-14 A B C D E
B NI NI NI < 0.5 <1.5
T NI NI NI < 0.5 <1.5
E NI NI NI < 0.5 <1.5
X NI NI NI < 0.5 <2.5
TPH NI NI NI < 5mg/l 1,200
MW-12 A B C D E
B NI NI 0.86 120 <1.5
T NI NI 0.81 3.8 1.6
E NI NI 0.51 0.6 <1.5
X NI NI 2.9 0.6 <2.5
TPH NI NI 610 < 5mg/l 230
MW-13 A B C D E
B NI NI NI 16 1.9
T NI NI NI 19 <1.5
E NI NI NI 3.0 <1.5
X NI NI NI 5.1 <2.5
TPH NI NI NI < 5mg/l 360
N
80 40 0 200
100 60 20 100
SCALE: 1" = 100'
LEGEND
MONITOR WELL
RECOVERY WELL
PROPOSED MONITOR WELL
PRODUCT RECOVERY WELL
A ANALYTICAL RESULTS FROM MARCH 1990
B ANALYTICAL RESULTS FROM APRIL 1990
C ANALYTICAL RESULTS FROM AUGUST 1990
D ANALYTICAL RESULTS FROM JANUARY AND FEBRUARY 1991
E ANALYTICAL RESULTS FROM JUNE 1991
NA NOT AVAILABLE
ND NO DETECTION
NS NOT SAMPLED
NI NOT INSTALLED AT THE DATE OF SAMPLING
B BENZENE
T TOLUENE
E ETHYLBENZENE
X TOTAL XYLENES
TPH TOTAL PETROLEUM HYDROCARBONS.
mg/l MILLIGRAMS PER LITER
NOTE:
CONCENTRATIONS IN MICROGRAMS PER LITER UNLESS OTHERWISE STATED.
GCL
PLATE 1
MONITOR WELL LOCATION MAP WITH BTEX AND TPH CONCENTRATIONS FROM 1990 TO PRESENT
CLIENT: PHILLIPS PETROLEUM COMPANY
DATE: SEPT. 5, 1991
CHECKED BY: M. NEE
DRAWN BY: J.T.N.
DWG. NO. BTEXTV2



GCL

PLATE 2
POTENTIOMETRIC SURFACE MAP
JUNE 26, 1991

CLIENT: PHILLIPS PETROLEUM COMPANY	
DATE: SEPT. 5, 1991	
CHECKED BY: M. NEE	
DRAWN BY: J.T.N.	
DWG. NO.	P1PSMJ91


P2
NORTH EVAPORATION POND (ABANDONED)
P1
MW-6
B NS
T NS
E NS
X NS
TPH NS
COUNTY ROAD
PLANT ROAD
W 1+00
0+00
E 1+00
E 2+00
E 3+00
E 4+00
E 5+00
E 6+00
E 7+00
E 8+00
E 9+00
E 10+00
E 11+00
E 12+00
E 13+00
E 14+00
E 15+00
TEXACO OIL WELL
FENCE
P4
P3
N 4+00
N 3+00
N 2+00
N 1+00
0+00
S 1+00
S 2+00
MW-5
B 5,000
T 570
E 15
X 88
TPH 31,000
MW-1
B <1.5
T <1.5
E <1.5
X <2.5
TPH 330
WS-2
B 280
T 27
E 1.8
X 2.5
TPH 1,500
10ppb BENZENE
1000ppb BENZENE
10,000ppb BENZENE
FENCE
EVAP. POND (CLOSED)
SKIMMER POND (CLOSED)
MW-3
B 43
T 5.7
E 1.5
X <2.5
TPH 750
WATER WELL
WS-1
B 6.5
T <1.5
E <1.5
X <2.5
TPH 64
MW-8
B 21,000
T 1,300
E 12
X 420
TPH 1,400
WATER WELL
RW-1
B NS
T NS
E NS
X NS
TPH NS
MW-2
B <1.5
T <1.5
E <1.5
X <2.5
TPH 480
MW-9
B 160
T 56
E 2.5
X 4.2
TPH 780
TRUCK ROUTE
MW-7
B 3,200
T 1,400
E 23
X 130
TPH 660
MW-4
B NS
T NS
E NS
X NS
TPH NS
P6
P5
MW-14
B <1.5
T <1.5
E <1.5
X <2.5
TPH 1,200
MW-10
B 9,700
T 420
E 84
X 39
TPH 1,300
MW-13
B 1.9
E <1.5
E <1.5
X <2.5
TPH 360
MW-12
B <1.5
T 1.6
E <1.5
X <2.5
TPH 230
MW-11
B <1.5
T <1.5
E <1.5
X <2.5
TPH 540
LEGEND
MONITOR WELL
RECOVERY WELL
PROPOSED MONITOR WELL
PRODUCT RECOVERY WELL
NS NOT SAMPLED DUE TO FREE PHASE HYDROCARBONS
B BENZENE (MICROGRAMS PER LITER)
T TOLUENE (MICROGRAMS PER LITER)
E ETHYLBENZENE (MICROGRAMS PER LITER)
X TOTAL XYLENES (MICROGRAMS PER LITER)
TPH TOTAL PETROLEUM HYDROCARBONS (MILLIGRAMS PER LITER)
FREE-PHASE PLUME
DISSOLVED-PHASE PLUME
N
80 40 0 200
100 60 20 100
SCALE: 1" = 100'
GCL
PLATE 3
PLUME BOUNDARY MAP FOR JUNE, 1991
CLIENT: PHILLIPS PETROLEUM COMPANY
DATE: SEPT. 5, 1991
CHECKED BY: M. NEE
DRAWN BY: J.T.N.
DWG. NO. JUNEPBMP

Final Phase Investigation Report
Lee Gas Plant,
Buckeye, New Mexico

February 24, 1992

Prepared for:

GPM Gas Corporation, formerly
Phillips 66 Natural Gas Company
4044 Penbrook
Odessa, Texas 79762

Prepared by:

H^{+}GCL

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Appendix

SECTION 1.0

1.0 Executive Summary

On October 16 through 30, 1991, six new groundwater monitor wells were installed at GPM Gas Corporation's (GPM's), formerly Phillips 66 Natural Gas Company, Lee Gas Plant, Buckeye, New Mexico. The objective of the monitor well installation was to identify the petroleum constituents in the groundwater entering and leaving the plant site.

The initial subsurface investigation at the site was initiated in 1988 with the closure of four RCRA monitor wells and the installation of four investigatory monitor wells. To date, sixteen groundwater monitor wells, four groundwater recovery wells, and one product recovery well are operational at the Lee Gas Plant.

In addition to monitor well installation, quarterly groundwater samples and samples from the newly installed monitor wells were collected and depth-to-water/separate-phase measurements were recorded. Separate-phase hydrocarbons were found to be present in recovery well RW-1 and monitor wells MW-6 and MW-4.

For quarterly sampling, the groundwater from monitor wells MW-9, MW-10, MW-12, MW-13, and MW-14 was sampled for petroleum constituents and major ions. Additionally, the new monitor wells MW-15 through MW-20 were also sampled for petroleum constituents and major ions.

The benzene concentrations in the samples from monitor wells MW-15 and MW-20 exceeded Water Quality Control Commission (WQCC) standards for benzene. The analytical results indicate that the BTEX constituents in all of the other samples were below WQCC standards.

The concentration of petroleum constituents in monitor wells MW-15, down-gradient of the northern evaporation pond, and MW-16, up-gradient of the northern evaporation pond, indicates that the northern evaporation pond could likely be a hydrocarbon source. The groundwater from monitor well MW-20 will be resampled during the quarterly sampling event in January to determine the validity of the initial sample results.

SECTION 2.0

2.0 Introduction

Since early 1988, Geoscience Consultants, Ltd., now H⁺GCL, has been involved in a subsurface investigation at GPM' Lee Gas Plant in southeastern New Mexico (GCL, 1988a). The results of the initial investigation indicated that both separate-phase and dissolved-phase hydrocarbons were present in the saturated zone beneath the site. Twenty groundwater monitor wells and one recovery well have been installed at the site. Three of the twenty monitor wells have been converted to recovery wells. The following is a brief history of the investigative and remediative actions performed at the facility:

- April 1988: Four monitor wells were installed and four other monitor wells were abandoned from a previously existing RCRA monitoring program (GCL, 1988a).

- September 1988: A limited soil-vapor survey identified two potential sources of hydrocarbon contamination (both former evaporation ponds, GCL, 1988b).

- January 1990: Jurisdiction of GPM' Lee Gas Plant was transferred from the New Mexico Environment Division (NMED) to the New Mexico Oil Conservation Division (NMOCD).

- April 1990: Four monitor wells and one recovery well were installed at the site to define limits of the separate-phase plume and to begin recovery of the floating product (GCL, 1990a).

- August 1990: Four additional monitor wells were installed to further define the lateral extent of dissolved-phase hydrocarbons in the aquifer (GCL, 1990b).

- January 1991: Two additional monitor wells were installed to delineate the leading edge of the dissolved-phase plume. Two existing monitor wells were converted to recovery wells (GCL, 1991).

- May 1991: Monitor well MW-10 was converted to a recovery well per NMOCDs' April 2, 1991, request (NMOCD, 1991).

- June 1991: All monitor wells were sampled for a one-time comprehensive sampling event at the Lee Plant and recommendations were made in September 1991 to the NMOCD for additional monitor well installation (H^+GCL, 1991).

On October 16 through 30, six new groundwater monitor wells were installed and groundwater samples were collected. Additionally, groundwater samples were collected from the wells that require quarterly sampling (MW-9, MW-11, MW-12, MW-13, MW-14).

These wells were designed for potential use in a final remedial action at the site. The new monitor well locations (MW 15-20) are shown on figure 2-1. Objectives for the installation of the new monitor wells are as follows:

- MW-15, down-gradient of the north evaporation pond, as requested by NMOCD.

- MW-16, up-gradient of the north evaporation pond, to characterize the groundwater up-gradient of the north evaporation pond and the plant.

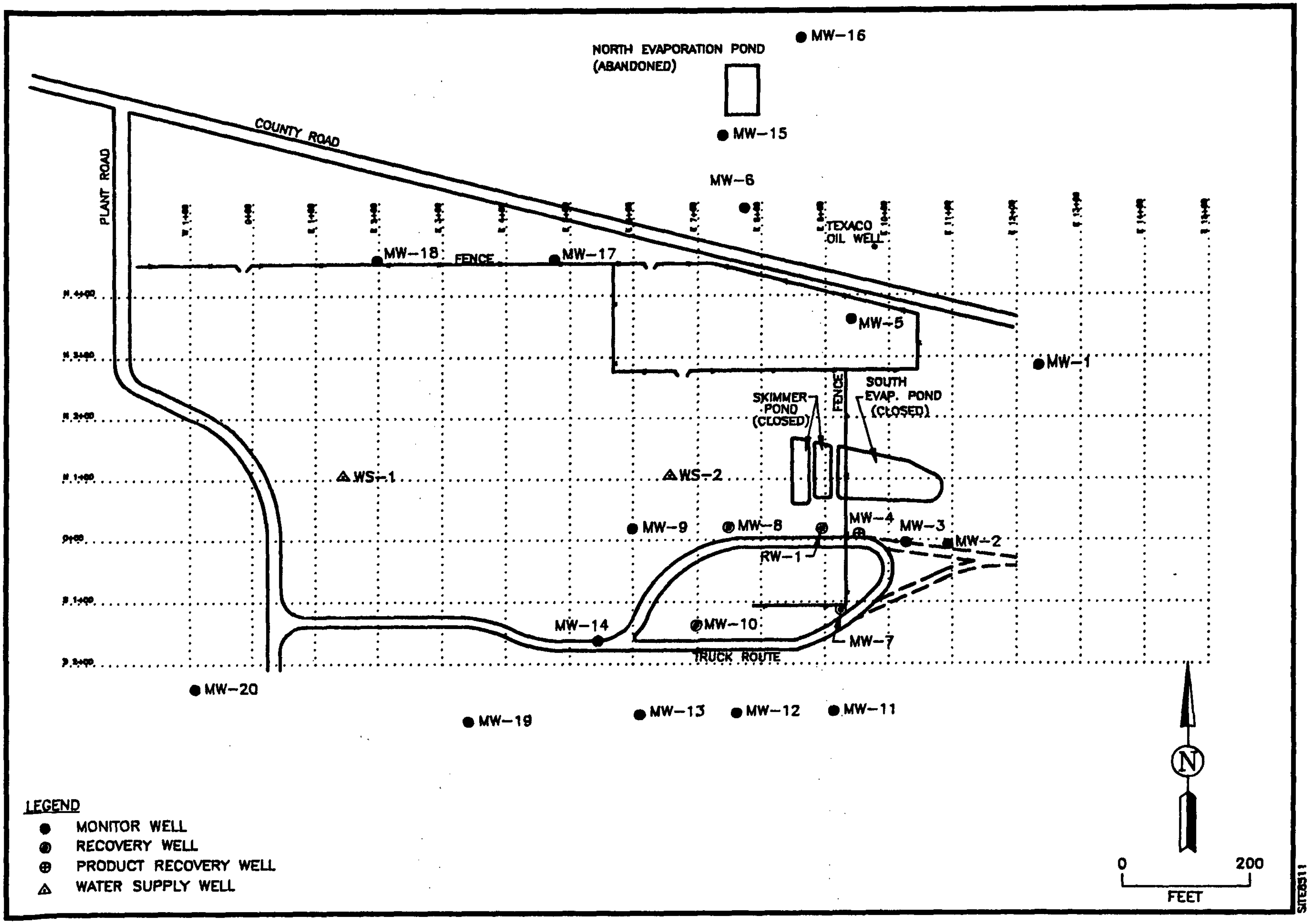
- MW-17 and MW-18, up-gradient of the plant, and south of the county road that is immediately north of the plant; to characterize the groundwater entering the plant up-gradient of water-supply well WS-1. Additionally, these wells could be used to investigate the lateral extent of dissolved-phase petroleum constituents associated with the separate-phase hydrocarbon contamination located southeast of the north evaporation pond.

- MW-19 and MW-20, down-gradient of the plant, to characterize the quality of the groundwater down-gradient of the plant.

- The analytical data obtained from the new monitor wells facilitate the development of a remedial strategy plan for the site.

Figure 2-1

Monitor Well Location Map, GPM Lee Plant



SECTION 3.0

3.0 Methodology

Borehole drilling, monitor well installations, and completion procedures were performed in the same manner as those of previous installations. The new monitor wells were developed with a submersible pump following the same procedures used in previous investigations (GCL, 1990b). The new monitor wells were developed until the parameters of pH, electric conductivity, and temperature were stabilized and until a volume of water greater than that lost during drilling had been recovered. Field notes documenting the well development data are included as appendix A.

The lithology of each of the new monitor well borings was logged on standard H⁺GCL lithologic forms and is presented in appendix B. The completion diagrams for these wells are included as appendix C.

During the October investigation, quarterly groundwater samples were collected from monitor wells MW-9, MW-10, MW-12, MW-13, and MW-14. These samples were collected according to the same protocol used in previous investigations, following strict sampling and chain-of-custody procedures (GCL, 1988c). Core Laboratories of Aurora, Colorado, performed the laboratory analyses of these samples for BTEX/TPH. Intermountain Laboratories of Farmington, New Mexico, performed the laboratory analyses for general chemistry constituents.

Product-thickness and depth-to-water measurements at all existing monitor wells were made both before and immediately after well installation using an ORS oil/water interface probe. Water levels fluctuate during pumping; therefore, measurements in the recovery wells during pumping operations are not representative of static conditions.

The new monitor wells were surveyed by John West Engineering Co. The locations were charted on the Lee Gas Plant's northing and easting coordinate system.

SECTION 4.0

Figure 4-1

Potentiometric Surface Map For October 30, 1991

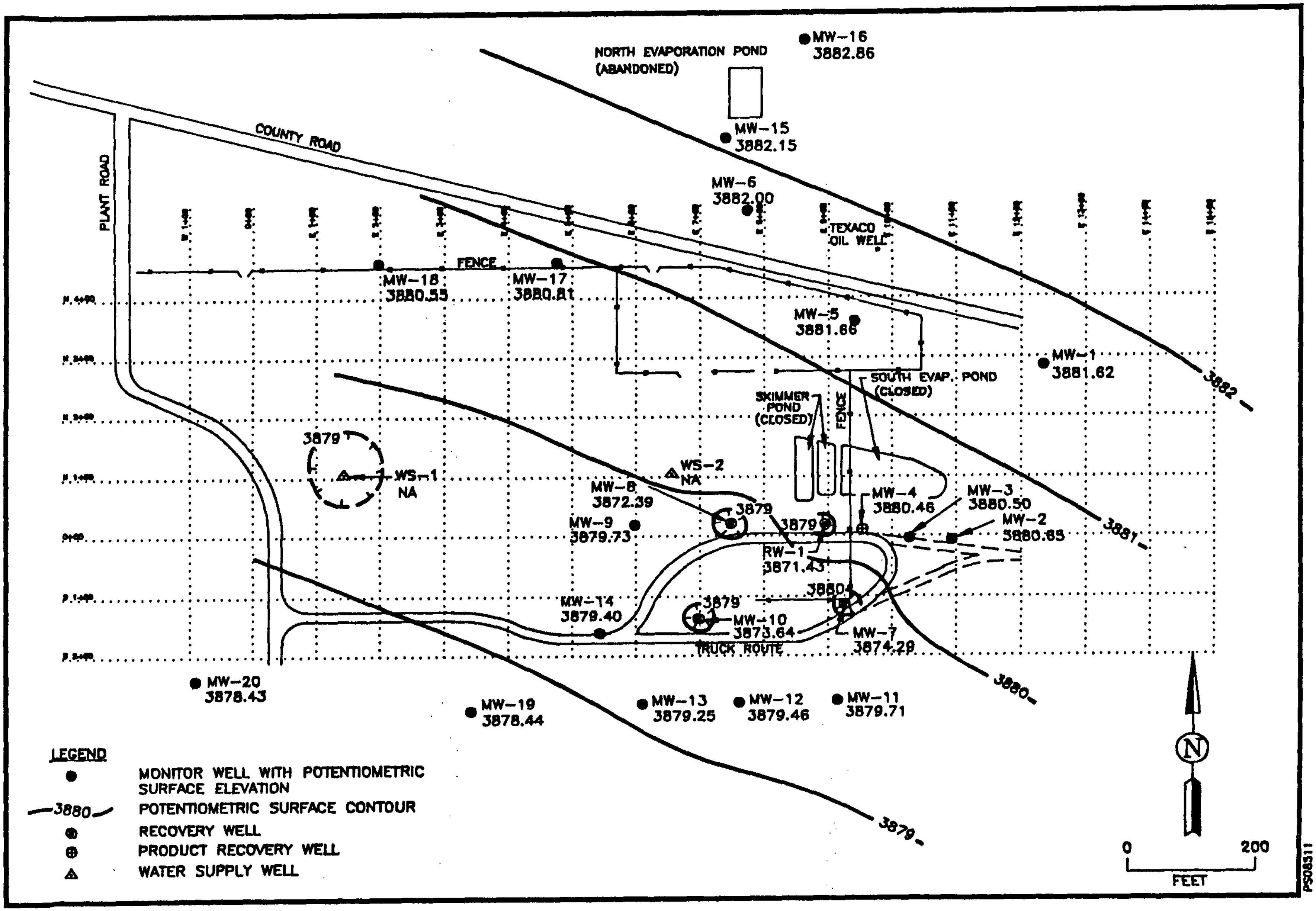


Figure 4-2

Monitor Well Location Map With BTEX And TPH Concentrations From October, 1991

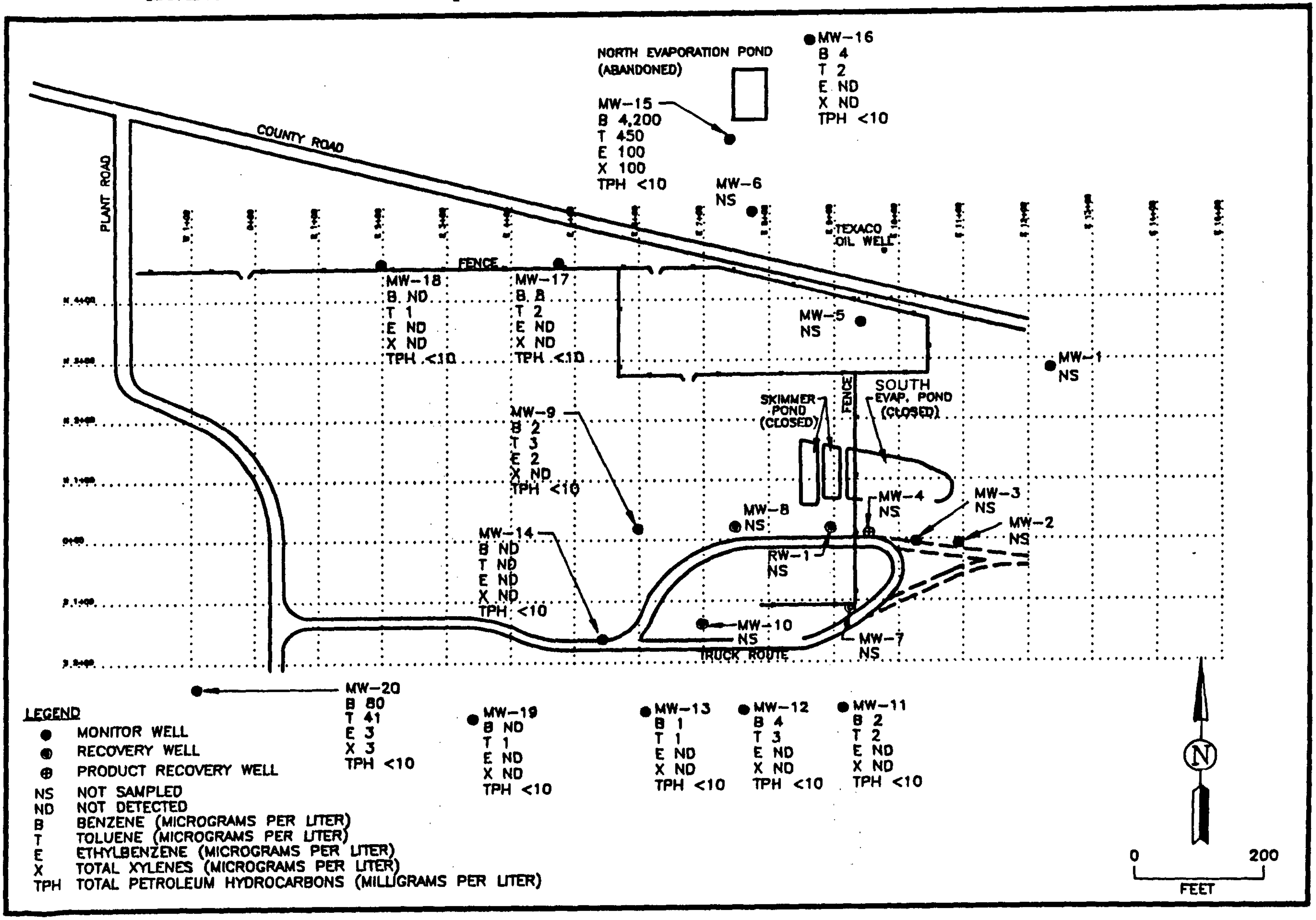


Table 4-1

Well and Water Surface Elevation Data, October 30, 1991

Location	Depth to Water Datum is TOC	Casing Elevation	Product Thickness	Potentiometric Surface Elevation
MW-1	97.63	3979.25	0	3881.62
MW-2	99.85	3980.50	0	3880.65
MW-3	99.77	3980.27	0	3880.50
MW-4	100.93	3980.16	1.54	3880.46
MW-5	98.16	3979.82	0	3881.66
MW-6	100.12	3981.79	0.41	3882.00
MW-7	105.43	3979.72	0	3874.29
MW-8	103.92	3981.31	0	3872.39
MW-9	100.44	3980.17	0	3879.73
MW-10	107.38	3981.02	0	3873.64
MW-11	98.79	3978.50	0	3879.71
MW-12	99.36	3978.82	0	3879.46
MW-13	101.27	3980.52	0	3879.25
MW-14	102.83	3982.23	0	3879.40
MW-15	99.55	3981.70	0	3882.15
MW-16	97.94	3980.80	0	3882.86
MW-17	100.99	3981.80	0	3880.81
MW-18	102.55	3983.10	0	3880.55
MW-19	102.36	3980.80	0	3878.44
MW-20	104.87	3983.30	0	3878.43
RW-1	109.42	3980.87	TR	3871.43

*Water surface elevation corrected for separate phase using a specific gravity for the product of approximately 0.8

All data are presented in feet
TR = Trace
TOC = Top of casing

0528/WWSURF10.WQ1

Table 4-2

Analytical Results from October 1991 Sampling Event

Location	Benzene (μg/L)	Toluene (μg/L)	Ethylbenzene (μg/L)	Total Xylenes (μg/L)	TPH (mg/L)
WQCC Standard	10	750	750	620	NA
MW-9	2	3	2	ND	<10
MW-11	2	2	ND	ND	<10
MW-12	4	3	ND	ND	<10
MW-13	1	1	ND	ND	<10
MW-14	ND	ND	ND	ND	<10
MW-15	4200	450	100	100	<10
MW-16	4	2	ND	ND	<10
MW-17	8	2	ND	ND	<10
MW-18	ND	1	ND	ND	<10
MW-19	ND	1	ND	ND	<10
MW-20	80	41	3	3	<10

TPH - Total Petroleum Hydrocarbons
ND - Not Detected

0528/RSLTS10.TBL

SECTION 5.0

5.0 Conclusions

The WQCC standard for benzene is 10 micrograms per liter (μg/L). The concentration of benzene exceeded WQCC standards in groundwater samples collected in October at wells MW-15 and MW-20; the concentrations found were 4,200 μg/L and 80 μg/L, respectively. The WQCC standard for ethylbenzene, toluene, and xylenes was not exceeded in any of the samples collected.

Depth-to-water measurements obtained from the new monitor wells indicate that the potentiometric surface remains relatively consistent across the site and is not significantly affected by the continuous pumping at water supply well WS-1. The direction of flow appears consistent at approximately 40 degrees west-of-south across the site. The gradient of the potentiometric surface is approximately 1 vertical foot for every 650 horizontal feet (.0015 ft/ft).

The separate-phase (free-phase) hydrocarbons that have been identified, figure 5-1 (H^+GCL, 1991), indicate that the product plumes are most likely associated with two sources, the southern evaporation pond and the northern evaporation pond, both of which are closed (figure 2-1).

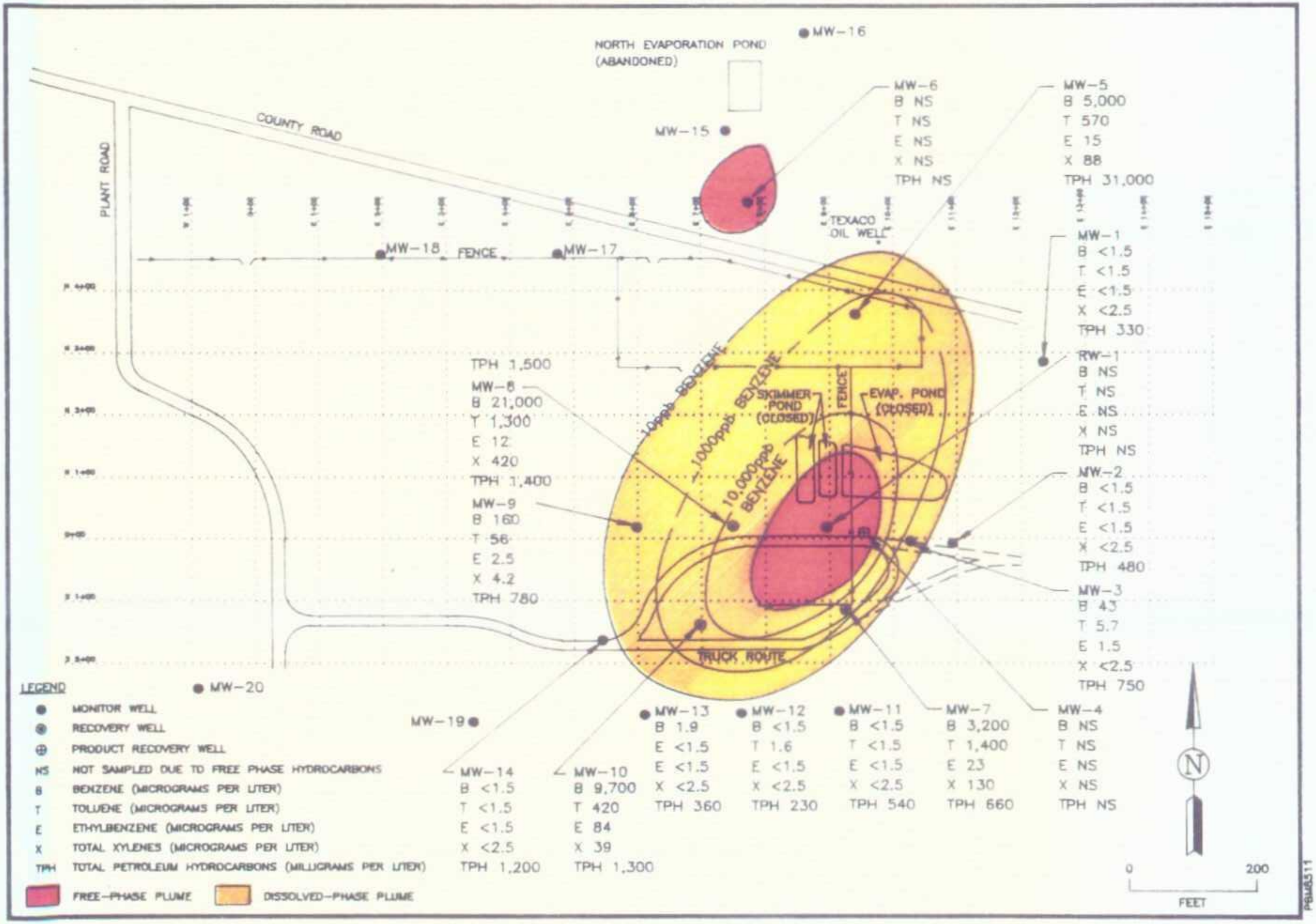
The analytical results for the sampled wells from the quarterly sampling event are consistent with past results. Low level dissolved-phase hydrocarbons are present down-gradient of the separate-phase hydrocarbons.

The groundwater up-gradient of the north evaporation pond has low concentrations of dissolved-phase hydrocarbons as does the groundwater from wells MW-17 and MW-18, off-gradient of the north evaporation pond and up-gradient of the plant. The concentrations of the dissolved-phase hydrocarbons in these wells are probably indicative of the ambient conditions in the oil field surrounding the site.

The groundwater from monitor well MW-15, directly down-gradient of the north evaporation pond, has high levels of dissolved-phase hydrocarbons. The source of these dissolved-phase hydrocarbons could likely be the north evaporation pond.

Figure 5-1

Plume Boundary Map For June, 1991



Laboratory analysis on the groundwater sample from monitor well MW-19, down-gradient of the plant, indicates that 1 part per billion (ppb) benzene is present. There appears to be no migration of hydrocarbons from the plant at this location.

The sample from monitor well MW-20 indicates that 127 ppb total BTEX is present in the groundwater at this location. The results are not indicative of ambient conditions, but they could be the result of laboratory contamination or sampling error.

SECTION 6.0

6.0 References

Geoscience Consultants, Ltd., For Phillips Petroleum Company, 1988a, "Report On The Installation Of A Groundwater Monitoring System at Phillips 66 Natural Gas Company," June 6, 1988.

Geoscience Consultants, Ltd., For Phillips Petroleum Company, 1988b, "Draft Limited Soil Vapor Survey, Phillips Lee Gas Plant," September 23, 1988.

Geoscience Consultants, Ltd., For Phillips Petroleum Company, 1988c, "Sampling and Analyses Plan for Phillips 66 Natural Gas Company Artesia, Eunice, Lee and Lusk Gasoline Plants," June 3, 1988.

Geoscience Consultants, Ltd., For Phillips Petroleum Company, 1990a, "Report of Subsurface Investigation Phillips 66 Natural Gas Company Lee Gas Plant," May 30, 1990.

Geoscience Consultants, Ltd., For Phillips Petroleum Company, 1990b, "Phase II Report of Subsurface Investigation Phillips 66 Natural Gas Company Lee Gas Plant," October 9, 1990.

Geoscience Consultants, Ltd., For Phillips Petroleum Company, 1991, "Phase III Report of Subsurface Investigation Phillips 66 Natural Gas Company Lee Gas Plant." March 11, 1990.

H⁺GCL, 1991, Phase IV Report of Subsurface Investigation Phillips 66 Natural Gas Company, Lee Gas Plant, September 5, 1991.

New Mexico Oil Conservation Division, To Phillips Petroleum Company, 1991, RE: Report of Subsurface Investigation Phillips 66 Natural Gas Company Lee Gas Plant Buckeye, New Mexico, Letter, April 2, 1991.

APPENDIX A

Appendix A

Well Development Data

10/16/91
H_2O LEVELS CONT.
RW1 111.27 pump
well meter reads
432723 Total gallons
mw 2 99.54
MW14 102.68
mw4 100.70 H_2O
99.16 prod (ORS)

10/16/91

0800 10/17/91
DAVID NEE
CLEAR ↑ 60's F

Set up to sample mw 11
BTEX, TPH and GENERAL CHEM.
Purge Volume:

TD	120'
H_2O	99
	21' H_2O

4" well
21 × .65 = 13.65 gals
× 3
purge = 40.95

PH 6.95 Fisher 107
Temp 64°F @ 5 gal
Cond 1100 chemtrix 700
SILTY

PH 6.90
Temp 64°F @ 10 gals
Cond 1210

PH 7.20
Temp 64°F @ 15 gals
Cond 1210

10 17 91

④

10/17/91

PH 7.20
Temp 64°F
Cond 1210
20 gals

PH 7.15
Temp 64°F
Cond 1210
25 gals

PH 7.05
Temp 64°F
Cond 1210
30 gals

PH 7.05
Temp 64°F
Cond 1210
35 gals

PH 7.10
Temp 64°F
Cond 1210
40 gals

Sampled MW11, using disposable bailer. Sample #9110170905

1100 Completed decon and.

[signature] 10/17/91

⑤

10/17/91

Set up to sample MW12 BTEX, TPH and General Chem.
Purge Volume:

TD 120
H_2O 99
21 ft H_2O

4" well 21 x .65 = 13.65 gals
x 3
purge vol 40.95 gal

PH 7.30
Temp 64°F
Cond 1150
@ 5 gals
Fisher Chemtrix
clear

PH 7.20
Temp ~~1175~~ 64°F
Cond 1125
@ 10 gals

PH 7.75
Temp 64°F
Cond 1125
@ 15 gals

PH 7.45
Temp 64°F
Cond 1100
@ 20 gals

[signature] 10-17-91

6 mw 12 cont. 10/17/91

PH 7.25
Temp 64°F 25 gals.
Cond 1100

PH 7.15
Temp 64°F 30 gals
Cond 1100

PH 7.10
Temp 64°F 35 gals
Cond 1100

PH 7.15
Temp 64°F 40 gals
Cond. 1090

PH 7.10
Temp 64°F 45 gals
Cond 1100

PH 7.20
Temp 64°F 50 gals
Cond 1100

1100 completed sampling
mw 12

10-17-91

10/17/91 7

Sample # 9110171100
1120
completed decon and set up to sample mw 13, BTEX, TPH, and General Chemistry

TD = 120 ft
H_2O = 101
19 ft H_2O

4" well
19 x .65 = 12.35
x 3.0
purge volume = 37.05 gals

PH 6.95
Temp 64°F
Cond 1050
Fisher @ 5 gals chemtrix

PH 6.75
Temp 64°F
Cond 1225
10 gals

PH 6.70
Temp 64°F
Cond 1350
15 gals

10-17-91

mw13 cont. 10/17/91

PH	6.70	
Temp	64°F	20 gals
Cond	1210	
PH	6.65	
Temp	64°F	25 gals
Cond	1250	
PH	6.70	
Temp	64°F	30 gals
Cond	1250	
PH	6.75	
Temp	64°F	35 gals
Cond	1250	
PH	6.70	
Temp	64°F	40 gals
Cond	1250	
PH	6.75	
Temp	64°F	45 gals
Cond	1250	

10-17-91

10/17/91

1230
completed sampling mw13
sample # 9110171230

1300
completed decon & took
Rinsate blanks for
BTEX & TPH #9110171240
CORE Labs
field Blanks for BTEX
& TPH #9110171245
CORE Labs

1315 set up to sample
mw14 BTEX, TPH &
General CHEMISTRY

TD = 120 ft
H_2O = 102
18 ft H_2O

4" well

18 x .65 = 11.70
x 3
purge vol. = 35.10 gals

10-17-91

10 mw 14 cont. 10/17/91

PH 6.85
Temp 65°F
Cond 1000
@ fisher 5 gals Chemtrix

PH 7.80
Temp 64°F
Cond 1000
10 gals

PH 7.70
Temp 64°F
Cond 1000
15 gals

PH 7.45
Temp 64°F
Cond 1000
20 gals

PH 7.60
Temp 64°F
Cond 975
25 gals

PH 7.45
Temp 64°F
Cond 975
30 gals

D— N—
10-17-91

10/17/91 11

PH 7.35
Temp 64°F ~~65~~ DN
Cond 975
35 gals

PH 7.40
Temp 64°F
Cond 975
40 gals

PH 7.45
Temp 64°F
Cond 950
45 gals

PH 7.45
Temp 64°F
Cond 950
50 gals

PH 7.50 DN
Temp 64°F
Cond 925
55 gals

PH 7.45
Temp 64°F
Cond 925
60 gals

D— N—
10-17-91

12

10/17/91

1430 Completed sampling
mw 14 # 911017 1425

1445 Completed decon
Set up to sample mw 9
Btex, TPH and General Chemistry

TD 120'
H_2O 100'
20 ft H_2O

4" well

20 x .65 = 13 ft gals
x 3
purge vol. 39 gals

PH 6.90
Temp 64°F @ 5 gals Fisher Chemtrix
Cond 1125

PH 6.75
Temp 64°F 10 gals
Cond 1200

PH 6.75
Temp 64°F 15 gals
Cond 1100

10-17-91

13

10/17/91

PH 6.80
Temp 64°F 20 gals
Cond 1100

PH 6.85
Temp 64°F 25 gals
Cond 1100

PH 7.05
Temp 64°F 30 gals
Cond 1100

PH 7.15
Temp 64°F 35 gals
Cond 1100

PH 7.05
Temp 64°F 40 gals
Cond 11.00

PH 7.15
Temp 64°F 45 gals
Cond 1100

10-17-91

(14) mw 9 cont. 10/17/91

pH	7.10	50 gals
Temp	64°F	
Cond	1100	
pH	7.15	55 gals
Temp	64°F	
Cond	1100	
pH	7.10	60 gals
Temp	64°F	
Cond	1100	

1550
completed Sampling mw 9
910171545
Took duplicate of
mw 9 # 910171700
identified on chain
of custody as mw 9A

1630
completed decon
& Clean up.
10 17 91

10/17/91 (15)

1645
Left site for day
all equipment secured
DN

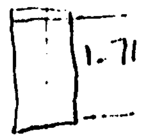
10 17 91

(16)

10/18/91

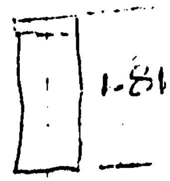
0730 DAVID NEE Clear ↑60's
TASK: Develop MW 16 ON
purge & sample
method sub pump.

0800 decon pump & hose
set pump over well
cut off casing stick
up 1.71 ft To Top



CUT →

To top of cap 1.81



CUT →

Set pump 2' off bottom
of well (~~121~~ (119')

Amount of 1120 to
recover 1,000 gal.

10 18 91

10/18/91 (17)

0845
asked Kyle if there
was any special way
he wanted to develop
well he said no, will
develop by raising
and lowering pump
@ 5' intervals every 200
gals.

1235 Field Chemistry

PH	6.85	Fisher Meter
Cond	450	900 gal
Temp	64°F	Chemtrix Meter
PH	6.85	
Cond	450	950
Temp	64°F	
PH	6.85	
Cond	450	955
Temp	64°F	

10 18 91

(18) 10/18/91

PH 6.85
Cond 450 — 960 gals
Temp 64°F

PH 6.85
Cond 450 — 965 gals
Temp 64°F

PH 6.85
Cond. 450 — 970 gals
Temp 64°F

PH 6.85
Cond 450 — 975 gals
Temp 64°F

PH 6.85
Temp ~~450~~ ON 64°F — 980 gals
Cond ON ~~to~~ 450

PH 6.85
Temp 64°F — 985 gals
Cond 450

10 18 91

10/18/91 (19)

PH 6.85
Temp 64°F — 990 gals
Cond 450

PH 6.85
Temp 64°F — 995 gals
Cond 450

PH 6.85
Temp 64°F — ~~9~~ ON 1000 gals
Cond 450

1320
Completed developing and sampling MW 16
turned equipment over to Kyle and left site.
Sample # 9110181300

Core lab C of C # 4457

Intermountain " 2615

10 18 91

22

MW-19 10-25

0830 Arrive on-site - will first plan out day, ready equipment, and get water levels in all wells.

0901 MW-20 DTW-104.7' (Fischer) No pid
MW-19 DTW-102.2' (Fischer) No pid.
MW-14 DTW-102.6' (Fischer) No pid.
MW-13 DTW

0952 Using these probes does not meet to my satisfaction. I have called the office to have solinst probes sent down.

1040 Have bailed silt from MW-20 setting up to purge. Flow meter reads 1890 - need 2500 = 4300

1117 Begin Pumping.

#	Temp	Cond	PH	
50	66°F	725	8.05	7gpm
100	65°F	1075	7.25	

KS ~~A~~ 1138 Stop to situate hose.
1442 Pumping again

K [signature] 10/30

23

MW-19

	#	T	Cond	PH	gpm
~~150~~ KS					
1146	150	65°	1250	7.70	7
1157	250	65°	1225	7.65	7+

1213 250 empty tank which was partially full.

1350 Resume Pumping. - stopped to call office

1408 Resume pumping

	#	T	Cond	PH	gpm
	400	66°	1220	7.05	7+
1423	500	66°	1200	6.90	7+
1440	620	66°	1140	7.00	7+

shut down to get gas

1502 resume pumping.

1512	700	66°	1100	7.05	7.5+
1522	800	66°	1075	7.00	7.5+
1535	900	66°	1025	7.00	7.5+

Empty tank

1639 Resume Purging

1650	1000	66°	1060	7.00	8
1711	1170	65°	1060	7.00 KS	
1732	1330	65	1020	~~7.10~~ 7.05	8

K [signature] 10/30

24 MW-19 10-25

#	T	Cond	PH	rate.
1747	-1445 stop to empty tank.			
1837	resume.			
1907	1670	65°	1050	7.90?
1924	1800	64°	~~1075~~ 1050 KS	7.85*

*PH meter may be fatigued. (Batt ?)

1948	1980	64°	980	7.85	
1951	Empty tank				
2040	Resume Pumping				
2049	2060	64°	935	7.80	
2056	2110	64°	940	7.75	7-8
2102	2160	64°	940	7.00*	
2112	2220	64°	940	~~7.30~~ KS 7.35	
~~2119~~	~~2275~~	~~64°~~ KS			
2119	2275	64°	940	7.30	
2126	2330	64°	940	7.35	
2133	2380	64°	940	7.35	
2139	2420	64°	940	7.35	

will pump to 2500, pull pump, and proceed w/samples.

2152 2520 gallons - will shut down pump & pull it.

K [signature] 10/30

25

2330 Sample # 911025 2330

2350 Will go move truck w/water trailer behind, and head to Motel after unloading.

Sample # 9110252330

TYPE: TPH/BTEX, Gen Chem, Cations, Anions

Containers: 3x 40ml VOAs - 2 have HCl
/ sulfuric
/ none

Core, IML

Core COC#

Loc: MW-19

IML COC#

2351 Samples locked in P/U.

KS

K [signature] 10/30

MW 10-27

MW-9 1120 [illegible]
MW-10 Pumping
meter on 10 must be
bad + it reads 140gpm
MW-14 102.86'
MW-16 97.91'
MW-15 99.53'
MW-6 100.08 Product present.

MW-17 100.98'
MW-18 102.57'
MW-1 97.60'
MW-5 98.16'
MW-7 Pumping
MW-4 - pump installed
RW-1 - pumping

MW-7 65385 1.0 gpm

K L—— 1/30

MW-17 10-27

1006 will get setup on MW-17
1017 Most of sand removed from bottom of well - will begin setting pump
1109 Initial meter read 4420
need 5420
1113 Pumping.
after 50 gallons - 7.5 gpm.
1128 Just found Kaler kit in Box + but Arrotte sent, will try to get product thickness if I have time - may have to wait till tomorrow.
1206 410 gallons
1223 530 gallons - empty tank.
1312 Resume pumping

	Ⓣ	Cond	PH	Temp	Rate
	600	925	6.75	66°	~7
1325	650	940	6.75	66°	
1333	700	960	6.85	66°	7.4
1341	760	960	6.95	66°	
1347	800	950	6.95	66°	
1352	840	960	6.95	66°	

Cont

K L—— 10/30

(32)

MW-17 10-27

	V	Cond	PH	Temp	Note
1359	900	960	6.85	66°	
1406	950	950	6.95	66°	
1414	1000	950	6.95	66°	

Will empty tank, pull pump & sample.

1425 Bad time on waste trailer finally okay. Operators way - put it washed.

1450 Sample at 1450
MW-17
#91102714 50
3x40ml VOA TPH, BTEX
2 [illegible] HCl pres.
Anions/Cations (Sulfate)
Gen Chem [illegible]
~~[illegible]~~, TML COC#
Cure COC #
FEDEX#

1500 Go to steam pump

K [illegible] 10/30

(33)

MW-18

1617 All I could get out of this hole was drilling mud - stops bailing, set pump

1637 Pump set up in MW-18 initial reading 5420 need 6120

1655 began pumping.
pumping slow - "muddy"

1643 Flow is so slow that flow meter isn't working well.

1645 Flow has picked up slightly

1656 Flow stopped?

1726 Pulled pump got it working again.

1737 Producing 1.5 gpm (ugh)
Looks like it could rain.

1743 Lower pump slightly.

1822 have only pumped ~130 gallons. will let well recover again for about 10 min in this time.

1832 Start up

1854 Pump rate is now Surging.

K [illegible] 10/30

10-27

Pumps at 1 gpm
then pumps to 8 gpm

1900 It has become very windy. Dust is pretty bad. Cold.

1906 240 gallons.

1911 Will perform avg. to see what pump rate is.
5.6 at 1913
270 gallons
4 to 4.3 gpm.

1916 Will shut off pump & let recover for 5 min. to "surge"

1930 330 - will begin readings @ 400 gallons.

	~~T~~	Cond.	pH	Temp	Rate
	~~400~~	~~400~~			
1949	410	400	7.65	65°	
2001	460	410	7.60	65°	

2004 Starting to rain.

2013	516	410	7.65	65°

2014 Tank full
Will empty tank & go to trailer - Complete this step see if weather blows through.

10/30

K

would be tough to sample in this - especially in dark.

0146 Storm has blown over but still is very cold & windy.

	~~T~~	Cond	pH	Temp	
0203	620	420	~~7.70~~ 7.55	64°	water clear
0214	670	410	7.60	65°	
0221	~~720~~ 710	540	7.60	65°	
0226	730	540	8.30	65°	

meters may be getting low on power.

0238	785	540	8.30	65°

currently over purge volume. will see if parameters stabilize.

0247	830	540	8.30	65°
0258	~~8~~ 880	540	8.30	65°
0309	930	540	8.30	65°

← Will pull pump empty tank & sample. not ~~sure~~ sure why pH is so high.
Total purge 937 gallons

10/30

K

(40) MW-11

	V	Cond	pH	Temp	rate
0831	225	~~1100~~ 965	7.55	65°	7.4
0839	280	920	7.60	65°	
0849	340	810	7.60	65°	
0858	410	760	7.65	65°	7.4
0905	460	700	7.65	65°	
0911	500	700	7.60	65°	

0913 Empty tank. (Let 1-the minimum first)

1006 Resume pumping

	~~V~~	Cond	pH	Temp	rate
1010	540	690	7.60	65°	
1014	570	650	7.65	65°	
1020	610	650	7.65	65°	
1025	645	650	7.65	65°	7.4
1032	700	650	7.65	65°	
1039	750	650	7.65	65°	

will stop pumping, empty tank & prepare to sample.

1140 Sample# 911029 1140
3 X 40 ml VOAs TPH/BTEX
2 have HCl
1 Anions/Cations (sulfuric)

K [signature] 10/29

Tews MW-20 10/29 (41)
1 Gen Chem (repres.)
TML COC#
CORE COC#

1221 Setting up on MW-20

1300 Have bailed sand out of well; will begin placing pump

1311 pump appears to be working. will go get water truck

1325 Current meter reading 7120 need 7920 - 800 gallons. I fear this well will be slow. ~~Begin Pumping~~

(1328 S) water slightly cloudy

1332 Water very cloudy.

1335 Flow rate surging

1336:30 7174 will avg flow rate.

1356:30 7208 118 gallons total 5.8 gpm according to avg

1353 will shut pump off for 5 or ten minutes - allow well to recover, then pump will "surge" upper sands.

1403 Resume pumping.

K [signature] 10/30

(42) MW-20 10/29

1413 7333 = 213 gallons
1425 7400 = 280 gallons clear
51.11 ~5.5 gpm
1450 420 gallons

	V	Cond	pH	temp	turb
1457	480	360	8.05	65°	~5
1503	500	360	8.20	65°	
1505	Empty trailer (water)				
1552	resume pumping				
1558	545	350	8.15	65°	
1609	605	350	8.10	65°	
1615	645	350	8.05	65°	
1622	680	350	8.05	65°	
1630	730	350	8.05	65°	
1632	745	350	8.05	65°	
1636	770	350	8.05	65°	
1640	790	350	8.05	65°	~5

800 stop development
emty water trailer, pull pump
sample.

1745 Sample
#9110291745
3X40ml VOA TPH/BTEX
2 have HCl pres

K L 10/30/91

Tuesday MW-20 10/29 (43)
Anions/Cations (Sulfur)
General Chemistry (none)

~~1900 Talked~~ ICS
TPH COC #
Core COC #
Fed Ex #

1901 Talked w/ Larry - he'll
pick up truck in morning,
I'll give him a ride.

1910 leave site.

K L 10/30

APPENDIX B

Appendix B

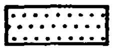
Lithologic Logs

Legend

Lithologic Symbols

 Caliche

 Clay

 Sand

Visual Percentage Symbols

0 = Clay

C = Caliche

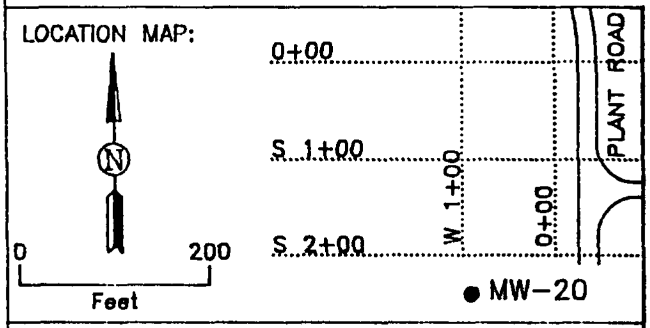
X = Sandstone

\+ = Sand

\- = Silt

MW-20 Lithologic Log

LOCATION MAP:



___1/4 ___1/4 NE 1/4 NW 1/4 S 31 T 17S R 35E

SITE ID: Phillips Lee LOCATION ID: MW-20
SITE COORDINATES (ft.):
N S2+40.46 E W0+91.12
GROUND ELEVATION (ft. MSL): 3981.5
STATE: N.M. COUNTY: Lea
DRILLING METHOD: Water Rotary
DRILLING CONTR.: Larry Felkins Drilling
DATE STARTED: 10-20-91 DATE COMPLETED: 10-21-91
FIELD REP.: K. Summers
COMMENTS:

LOCATION DESCRIPTION:

Depth	Visual %	Lith	Drilling Time Scale:	Sample Type and Interval
	C C C C C C 0 0 + −			
	C C C C C C C 0 + −			
5	C C C C C C C 0 + −			
10	C C C C C C C C + 0			
15	C C C C C + + + + X			
20	+ + + + + + + X X X			
	+ + + + + X X X C C			
25	+ + + + X X X − − −			
30	X X X X X C C C C +			
35	X X X X X C C C C +			
	+ + + + + X X X C C			
40	+ + + + + X X X C C			
45	+ + + + + X X X C C			
50	+ + + + + + + X X −			

Lithologic Description

0–2'	Clay/Caliche Clay is dk ylsh brn 10 YR 4/4, Cche is very pale orange 10 YR 8/2. 60% caliche, 40% clay to v fine sands. Cche from 0–2' is unbedded cobbles (fill).
2–5'	Caliche Mod orange pink 5 YR 8/4 to grayish orange 10 YR 7/4, 70% Cche, 30% clay to v fine sands. Cche is well cons, cuttings are from clay to pea gravel sized. Sands are rndd to sbrndd, unconsolidated.
5–10'	Caliche Same
10–15'	Caliche Same but 80% Cche, 20% clay to fine sands.
15–20'	Caliche/Sand Grayish orange 10 YR 7/4, 40% v fine to fine sands, 10% sandstones, 50% Cche. Sands are well rndd, well sorted, uncons. Sandstones are of same texture and mod–well cons.
20–23'	Sand/Sandstone Same but w/0% caliche.
23–25'	Sand/Sandstone Mod orange pink 5 YR 8/4, same as above w/50% v fine to fine sands, 30% sandstones, 20% paleocaliche.
25–30'	Sandstone/Sand Mod ylsh brn to dk ylsh brn 10 YR 6/6, 70% sand (v fine to fine) 30% silt v fine to fine sands are rndd, well sorted, cons to uncons. Interbedded thin (0–6") loose sands from 25–37'.
30–35'	Sandstone/Cche Grayish orange pink 5 YR 7/2, cuttings from silt to pea gravel sized w/large cuttings highly ang 50% sandstone, 40% paleocaliche. 10% v fine to fine sands. Sands are rndd, uncons, well sorted. Sstones are same, but mod well cons.
35–38'	Sandstone/Caliche Same
38–40'	Sand/Sandstone Grayish orange pink 5 YR 7/2, cuttings size same as above, but, 50% v fine to fine sands, 30% sandstones, 20% paleocaliche. Sands are rndd, uncons, well sorted, stones are same w/mod well cons.
40–45'	Sand/Sandstones Same
45–50'	Sand/Sandstone Same
50–55'	Sand/Sandstone Grayish orange pink 5 Yr 7/2, same, but w/70% v fine to fine sands 20% sandstones, 10% silts.

MW-20 Lithologic Log
(Continued)

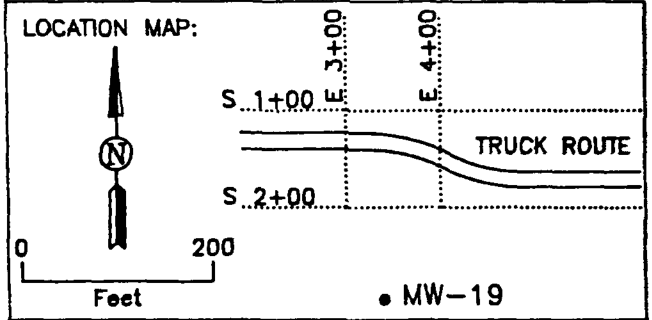
Depth	Visual %	Lith	Drilling Time Scale:	Sample Type and Interval	Lithologic Description
50					
55	+ + + + + + + X X –				55–60' **Sand/Sandstone** Same
60	+ + + + + + + X X X				60–65' **Sand/Sandstone** Lt brn 5 YR 6/4, 70% v fine to fine sands, 30% thin sandstones. Sands are rndd to sbrndd, uncons to mod cons, well sorted.
65	+ + + + + + + X X X				65–70' **Sand/Sandstone** Same
70	+ + + + + + + X X X				70–75' **Sand/Sandstone** Lt brn 5 YR 6/4, otherwise same as above 75–80' **Sand** Mod ylsh brn 10 YR 5/4, 80% fine to v fine sands, 10% silt, 10% sandstones. Sands are well rndd, well sorted mod cons (sandstones) to uncons.
75	+ + + + + + + + X –				
80	+ + + + + + + + X –				80–85' **Sand** Same
85	+ + + + + + + + X –				85–90' **Sand** Same
90	+ + + + + + + + X –				90–95' **Sand** Same but w/thin (6") sandstones at 91' and 94'.
95	+ + + + + + + + X –				95–100' **Sand** Same as 75–80'.
100	+ + + + + + + + X –				100–105' **Sand** Same
105	+ + + + + + + + X –				105–110' **Sand** Same
110	+ + + + + + + X X –				110–115' **Sand** Same w/1' sandstones at 114'.
115	+ + + + + + + + X –				115–120' **Sand** Same as 75–80'.

MW-20 Lithologic Log
(Continued)

Depth	Visual %	Lith	Drilling Time Scale:	Sample Type and Interval	Lithologic Description
115					
120	+ + + + + + + + X –				120–125' Sand Some
125	+ + + + + + + + X –				
130					TD = 130'
135					
140					
145					
150					
155					
160					
165					
170					
175					
180					

MW-19 Lithologic Log

LOCATION MAP:

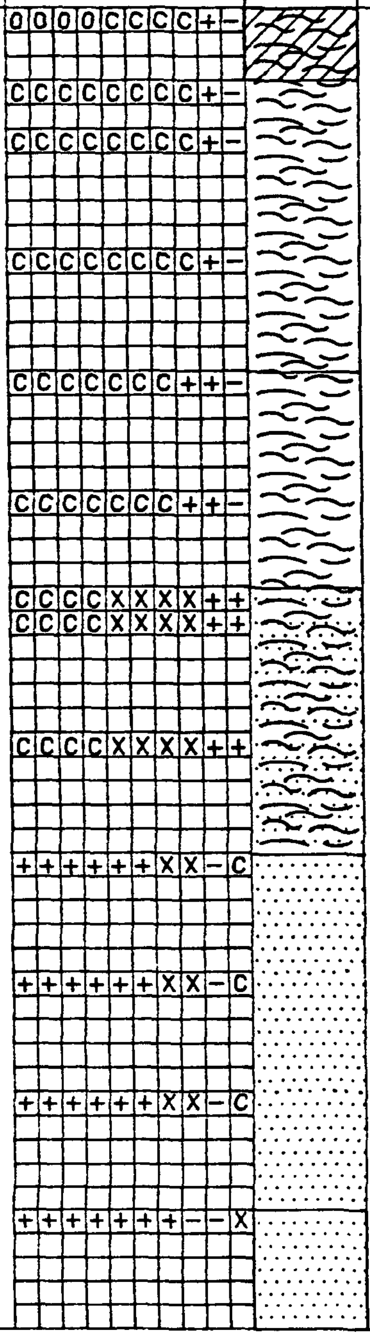


__1/4 __1/4 NW 1/4 NE 1/4 S 31 T 17S R 35E

SITE ID: Phillips Lee LOCATION ID: MW-19
SITE COORDINATES (ft.):
N S2+94.25 E E3+40.52
GROUND ELEVATION (ft. MSL): 3979.7
STATE: N.M. COUNTY: Lea
DRILLING METHOD: Water Rotary
DRILLING CONTR.: Larry Felkins Drilling
DATE STARTED: 10-22-91 DATE COMPLETED: 10-23-91
FIELD REP.: K. Summers
COMMENTS:

LOCATION DESCRIPTION:

Depth	Visual %	Lith	Drilling Time Scale:	Sample Type and Interval	Lithologic Description



Interval	Lithologic Description
0–3'	Clay/Caliche Clay is dk ylsh brn 10 YR 4/4 to grayish brn 5 YR 3/2, Caliche cobbles present, but not bedded. 40% clay, 40% caliche fragments, 20% silts and fine sands. Sands are sbrndd, uncons, mod well sorted.
3–5'	Caliche Mod ylsh brn 10 YR 5/4 to grayish orange 10 YR 7/4, 80% Cche, 20% silts to fine sands. Sands are sbrndd to ang, uncons. Cche is well cons. Cuttings are clay to coarse sand sized.
5–10'	Caliche Same
10–15'	Caliche Same but harder.
15–20'	Caliche Grayish orange 10 YR 7/4, 70% Cche, 30% silt to fine sands. Sands are sbang to rndd, well sorted, semi cons in Cche. Cuttings are clay to v coarse sand sized.
20–24'	Caliche Same
24–25'	Caliche/Sandstone Grayish orange pink 5 YR 7/2, 20% v fine to fine sands, 40% sandstone, 40% Cche. Sands are rndd, well sorted, uncons sandstones of same texture are well cons. Cuttings are silt to med pea-gravel sized.
25–30'	Caliche/Sandstone Same
30–35'	Caliche/Sandstone Same
35–40'	Sand/Sandstone Grayish orange pink 5 YR 7/2, 60% v fine to fine sands, 10% silts, 20% sandstones, 10% paleocaliche. Sands are rndd to sbrndd, well sorted, interbedded w/sandstones of same texture and with Cche.
40–45'	Sand/Sandstone Same
45–50'	Sand/Sandstone Same
50–55'	Sand/Sandstone Same but w/70% v fine to fine sands, 20% silts, 10% sandstone.

MW-19 Lithologic Log
(Continued)

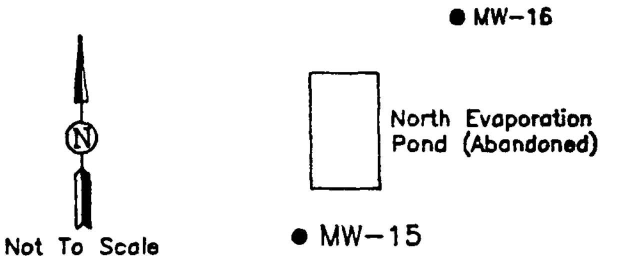
Depth	Visual %	Lith	Drilling Time Scale:	Sample Type and Interval	Lithologic Description
50					
55	+ + + + + + + − − X				55–60' Sand/Sandstone Same
60	+ + + + + + + + + X				60–65' Sand Lt brn 5 YR 6/4, 90% v fine to fine sands, 10% sandstones. Sands are rndd, well sorted, uncons. Sandstones of same texture are well to mod cons.
65	+ + + + + + + + + X				65–70' Sand Same
70	+ + + + + + + X X X				70–75' Sand/Sandstone Lt. Brn 5 YR 6/4, 70% v fine to fine sands, 30% sandstones. Sands are rndd, well sorted, uncons. Sandstones of same texture are well cons.
75	+ + + + + + + X X X				75–80' Sand/Sandstone Same
80	+ + + + + + + + X −				80–85' Sands Mod ylsh brn 10 YR 5/4, 80% v fine to fine sands, <10% silts, 10% sandstones. Sands are rndd, uncons well sorted. Sandstones of same texture are mod-well cons.
85	+ + + + + + + + X −				85–90' Sand Same
90	+ + + + + + + + X −				90–95' Sand Same
95	+ + + + + + + + X −				95–100' Sand Same w/thin sandstone (~4") at 96'.
100	+ + + + + + + + X −				100–105' Sand Same 90'–95'.
105	+ + + + + + + + X −				105–110' Sand/Sandstone Mod ylsh brn 10 YR 5/4, same as above, with 1–2" sandstones at ~105 and 108'.
110	+ + + + + + + + X −				110–115' Sand Same as 100–105'.
115	+ + + + + + + + X −				115–120' Sand Same

MW-19 Lithologic Log
(Continued)

Depth	Visual %	Lith	Drilling Time Scale:	Sample Type and Interval	Lithologic Description
115					
120	+ + + + + + + + X −				120–125' <u>Sand</u> Same
125	+ + + + + + + + X −				125–130' <u>Sand</u> Same
130					TD = 130'
135					
140					
145					
150					
155					
160					
165					
170					
175					
180					

MW-15 Lithologic Log

LOCATION MAP:



___1/4 ___1/4 SW 1/4 SE 1/4 S 30 T 17S R 35E

SITE ID: Phillips Lee LOCATION ID: MW-15
SITE COORDINATES (ft.):
N N 6+56.33 E E 7+38.75
GROUND ELEVATION (ft. MSL): 3979.8
STATE: N.M. COUNTY: Lea
DRILLING METHOD: Water Rotary
DRILLING CONTR.: Larry Felkins Drilling
DATE STARTED: 10-17-91 DATE COMPLETED: 10-19-91
FIELD REP.: K. Summers
COMMENTS:

LOCATION DESCRIPTION:

Depth	Visual %	Lith	Drilling Time Scale:	Sample Type and Interval	Lithologic Description
	O O O O C C C C + -				
	C C C C C C C C + -				0-2' <u>Clay/Caliche Cobbles</u> Clay is dk ylsh brn 10 YR 4/4 to grayish brn 5 YR 3/2, Cche is not bedded. 40% clay, 40% Cche frags, 20% silts and v fine sands. Sands are sbrndd to sbang, unconsol, mod well sorted.
5	C C C C C C C C + -				2-5' <u>Caliche</u> Mod orange pink 5 YR 8/4, 80% Cche, 20% silts to v fine sands. Cche is well cons. Cuttings are from clay to pea gravel sized.
10	C C C C C C C C + -				5-10' <u>Caliche</u> Same
15	C C C C C C C C + -				10-15' <u>Caliche</u> Same, very hard.
					15-17' <u>Caliche</u> Same
	+ + + + + + + + X -				17-20' <u>Sand/Sandstone</u> grayish orange 10 YR 7/4, 80% v fine to fine sand, 10% sandstones, 10% silts. Sands are rndd, well sorted, uncons. Sandstones of same texture are mod well cons. (calcite?)
20	+ + + + + X X X C C				20-23' <u>Sand/Sandstone</u> Same
25	+ + + + + X X X C C				23-25' <u>Sand/Sandstone</u> Mod. orange pink 5 YR 8/4, same as 17'-20' w/50% sands, 30% sand stones, 20% paleocaliche, very little silt.
					25-30' <u>Sand/Sandstone</u> Same
30	X X X X X C C C C +				30-35' <u>Sandstone/Caliche</u> Grayish orange pink 5 YR 7/2, cutings range in size from silt to fine pebble gravel. Larger cuttings are highly angular. 50% sandstone, 40% paleocaliche, 10% v fine to fine sands. Sands are rndd, uncons, well sorted.
35	X X X X X C C C C +				35-37' <u>Sandstone/Caliche</u> Same
	+ + + + + X X - - C				37-40' <u>Sand/Sandstone</u> Same, but 50% sands, 20% silts, 20% sandstones, 10% paleocaliche. Overall less consolidation.
40	+ + + + + X X O - C				40-45' <u>Sand/Sandstone</u> Grsh orange pink 5 YR 7/2, 50% v fine to fine sands, 20% silts and clays, 20% sandstones, 10% paleocaliche. Sands are rndd to sbang, well sorted, interbedded w/sstones and Cche.
45	+ + + + + X X O - C				45-50' <u>Sand/Sandstone</u> Same
50	+ + + + + + + O - X				50-55' <u>Sand/Sandstone</u> Grayish orange pink 5 YR 7/2, same as above but w/70% v fine to fine sands, 20% silts and clays, 10% sandstone.

MW-15 Lithologic Log
(Continued)

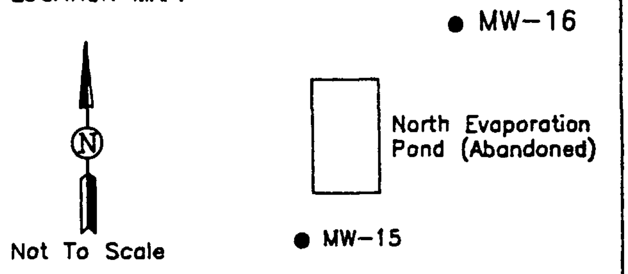
Depth	Visual %	Lith	Drilling Time Scale:	Sample Type and Interval	Lithologic Description
50					
55	+ + + + + + + 0 – X				55–60' Sand/Sandstone Same
60	+ + + + + + + + X –				60–65' Sand Lt brn 5 YR 6/4, 80% v fine to fine sands, 10% thin sandstones, <10% silts. Sands are well sorted, uncons, rndd to sbrndd.
65	+ + + + + + + + X –				65–70' Sand Same
70	+ + + + + + + X X X				70–75' Sand/Sandstone Lt brn 5 YR 6/4, 30% sandstones, 70% v fine to fine sands. Sands are rndd, well sorted, uncons. Sandstones appear to have calcite cement and are well cons.
75	+ + + + + + + + X –				75–80' Sand Mod ylsh brn 10 YR 5/4, 80% fine to v fine sands, 10% sandstone, 10% silt. Sands are well rndd, uncons, well sorted.
80	+ + + + + + + + X –				80–85' Sand Same
85	+ + + + + + + + X –				85–90' Sand Same
90	+ + + + + + + X X –				90–95' Sand Same but w/thin sandstone beds.
95	+ + + + + + + + X –				95–100' Sand Same as 85–90'.
100	+ + + + + + + + X –				100–105' Sand Same
105	+ + + + + + + + X –				105–110' Sand Same
110	+ + + + + + + + X –				110–115' Sand Same
115					

MW-15 Lithologic Log
(Continued)

Depth	Visual %	Lith	Drilling Time Scale:	Sample Type and Interval	Lithologic Description
115	+ + + + + + + X X –				115–120' <u>Sand</u>, Same w/thin sandstone at 117'.
120	+ + + + + + + X X –				120–125' <u>Sand</u> Same
125					TD = 125'
130					
135					
140					
145					
150					
155					
160					
165					
170					
175					
180					

MW-16 Lithologic Log

LOCATION MAP:



___1/4 ___1/4 ___1/4 ___1/4 S 30 T 17S R 35E

SITE ID: Phillps Lee LOCATION ID: MW-16
SITE COORDINATES (ft.):
N N 8+12.07 E E 8+62.34
GROUND ELEVATION (ft. MSL): 3979.4
STATE: N.M. COUNTY: Lea
DRILLING METHOD: Water Rotary
DRILLING CONTR.: Larry Felkins Drilling
DATE STARTED: 10-16-91 DATE COMPLETED: 10-19-91
FIELD REP.: K. Summers
COMMENTS:

LOCATION DESCRIPTION: North Of Former Evaporation Pond, North Of Plant

Depth	Visual %	Lith	Drilling Time Scale:	Sample Type and Interval
0	O O O O C C C C + −			
5	C C C C C C C C + −			
10	C C C C C C C C + −			
15	C C C C C C C C + −			
19	+ + + + + + + + X −			
20	+ + + + + + X X C C			
25	+ + + + + + X X C C			
30	+ + + + + + X X C C			
31	X X X X X C C C C +			
35	X X X X X C C C C +			
40	+ + + + + − − X X C			
41	+ + + + + X X O − C			
45	+ + + + + X X O − C			
50	+ + + + + + + − − X			

Lithologic Description

0–2' Clay/Caliche Cobbles
Clay is dk ylsh brn 10 YR 4/4 to grayish brn 5 YR 3/2. Cche present but not bedded. 40% clay, 40% Cche frags, 20% silts and v fine sands. Sands are sbrndd to sbang, uncons, mod well sorted.

2–5' Caliche
Mod orange pink 5 YR 8/4, cuttings are clay to pea gravel sized. 80% Cche, 20% silts and v fine sands. Cche is well cons.

5–10' Caliche Same

10–15' Caliche Same

15–19' Caliche Same
but w/10% sandstones.

19–20' Sand/Sandstone
Grayish orange 10 YR 7/4, 80% v fine to fine sands, 10% sandstones, 10% silts. Sands are rndd, well sorted, uncons. Sandstones are of same texture, mod-well cons w/calcite.

20–25' Sand Sandstone Same
but w/60% sands, 20% sandstones, 20% paleocaliche, very little silt.

25–30' Sand/Sandstone Same
but mod orange pink 5 YR 8/4.

30–31' Sand/Sandstone Same

31–35' Sandstone/Caliche
Grayish orange pink 5 YR 7/2, cuttings range in size from silts to fine pebble gravel, larger cuttings are highly angular. 50% sandstone, 10% v fine sands and silts, 40% paleocaliche.

35–40' Sandstone/Caliche Same

40–41' Sand/Sandstone Same
but 20% silts 50% sands, 20% sandstone, 10% paleocaliche. Sands are rndd, well sorted, uncons.

41–45' Sand/Sandstone
Grysh orange pink 5 YR 7/2, 50% v fine to fine sands, 20% silts and clays, 20% sandstones, 10% paleocaliche. Sands are rndd to sbang, well sorted, interbedded w/sandstones and Cche.

45–50' Sand/Sandstone Same

50–60' Sand/Sandstone
Grayish orange pink 5 YR 7/2, same as above w/70% v fine to fine sands, 20% silts and clays, 10% sandstone, very little Cche.

MW-16 Lithologic Log
(Continued)

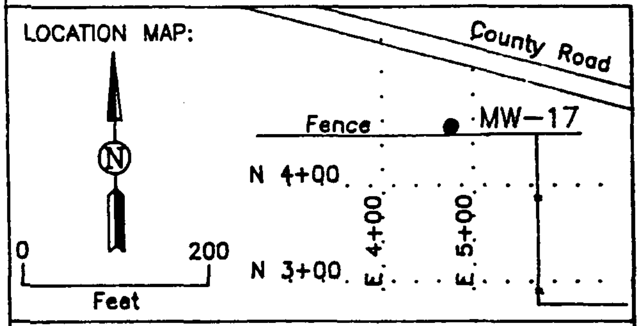
Depth	Visual %	Lith	Drilling Time Scale:	Sample Type and Interval	Lithologic Description
50					
55	+ + + + + + + − − X				
60	+ + + + + + + + − X				60–65' Sand Light Brn 5 YR 6/4, 80% v fine to fine sands, <10% silts/clays, <10% thin bedded sandstones. Sands are well sorted, rndd, uncons to med cons.
65	+ + + + + + + + − X				65–70' Sand Same
70	+ + + + + + X X X X				70–75' Sand/Sandstone Lt brn 5 YR 6/4, 60% v fine to fine sands, 40% sandstones. Sands are rndd, well sorted, uncons sandstones are of same texture, well cons (prob calcite cemented).
75	+ + + + + + + + X −				75–80' Sand Mod ylsh brn 10 YR 5/4, 80% v fine to fine sands, <10% silts, <10% thin bedded sandstones. Sands are well rndd, uncons, well sorted.
80	+ + + + + + + + X −				80–85' Sand Same
85	+ + + + + + + + X −				85–90' Sand Same
90	+ + + + + + + + X −				90–95' Sand Same
95	+ + + + + + + X X −				95–100' Sand Same but w/thin sandstone ~10%.
100	+ + + + + + + X X −				100–105' Sand Same
105	+ + + + + + + + X −				105–110' Sand Same
110	+ + + + + + + + X −				110–115' Sand Same
115	+ + + + + + + + X −				115–120' Sand Same

MW-16 Lithologic Log
(Continued)

Depth	Visual %	Lith	Drilling Time Scale:	Sample Type and Interval	Lithologic Description
115	+ + + + + + + + X –				
120					120–125' Sand Same
125					TD = 125'
130					
135					
140					
145					
150					
155					
160					
165					
170					
175					
180					

MW-17 Lithologic Log

LOCATION MAP:



__1/4 __1/4 SW 1/4 SE 1/4 S 30 T 17S R 35E

SITE ID: Phillips Lee LOCATION ID: MW-17
SITE COORDINATES (ft.):
N N4+58.84 E E4+74.89
GROUND ELEVATION (ft. MSL): 3980.2
STATE: N.M. COUNTY: Lea
DRILLING METHOD: Water Rotary
DRILLING CONTR.: Larry Felkins Drilling
DATE STARTED: 10-22-91 DATE COMPLETED: 10-23-91
FIELD REP.: K. Summers
COMMENTS:

LOCATION DESCRIPTION:

Depth	Visual %	Lith	Drilling Time Scale:	Sample Type and Interval	Lithologic Description
0	0 0 0 0 C C C C + −				0–2' Clay/Caliche Clay is dk ylsh brn 10 YR 4/4, Cche cobbles present at 40% (not bedded), 40% clay, 20% silts to fine sands. Sands are sbrndd, uncons, mod well sorted w/clays.
	C C C C C C C C + −				2–5' Caliche Mod orange pink 5 YR 8/4, 80% Cche, 10% v fine to fine sands, 10% silts. Cuttings are clay to pea gravel sized. Sands are sbang to rndd, well sorted, interbedded w/Cche. Cche is well cons.
5	C C C C C C C C + −				5–10' Caliche Same
10	C C C C C C C C + −				10–15' Caliche Same
15	C C C C C C C C + −				15–18' Caliche Same
	C C C C C C + + + +				18–20' Caliche/Sand Grayish orange 10 YR 7/4, 60% Cche, 40% v fine sands. Cuttings range in size from silt to v coarse sand sized. Sands are sbrndd, well sorted, uncons.
20	X X X X X C C C C +				20–25' Sandstones/Caliche Mod orange pink 5 YR 8/4, 50% sandstones, 40% paleocaliche, 10% v fine to fine sands. Cuttings range from pea gravel to v fine sands. Sands are well rndd to sbrndd, well sorted, uncons. Sandstones are of same texture and well consolidated.
25	X X X X X C C C C +				25–30' Sandstone/Caliche Same
30	X X X X X C C C C +				30–35' Sandstone/Caliche Same 35–39' Sandstone Grayish orange pink 5 YR 7/2, 80% sandstone, 10% v fine sands, 10% Cche. Sands are rndd, well sorted, well cons.
35	X X X X X X X X C +				39–40' Sand/Sandstone Grayish orange pink 5 YR 7/2, 60% v fine to fine sands, 20% clays and silts. 20% sandstones. Sands are rndd to sbang, well sorted, interbedded w/sandstones.
40	+ + + + + + X X 0 − + + + + + + X X 0 −				40–45' Sand/Sandstone Same
45	+ + + + + + X X 0 −				45–50' Sand/Sandstone Same
50	+ + + + + + + + C X				50–55' Sand/Sandstone Grayish orange pink 5 YR 7/2, 80% v fine to fine sands, 10% sandstones, 10% Cche. Sands are sbrndd to rndd, well sorted, uncons to mod cons.

MW-17 Lithologic Log
(Continued)

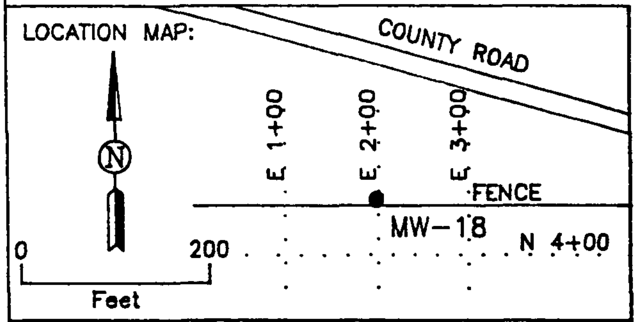
Depth	Visual %	Lith	Drilling Time Scale:	Sample Type and Interval	Lithologic Description
50					
55	+ + + + + + + + C X				55–60' Sand/Sandstone Same
60	+ + + + + + + + X –				60–65' Sand Light brn 5 YR 6/4, 80% v fine to fine sands, 10% thin bedded sandstones, <10% clays, silts, Cche. Sands are well rndd, uncons, well sorted.
65	+ + + + + + + + X –				65–70' Sand Same
70	+ + + + + + + + X –				70–75' Sand Same 75–80' Sand/Sandstone Lt. brn 5 YR 6/4, 60% v fine to fine sand, 40% sandstone. Sands are rndd, well sorted, uncons. Sandstones are of same texture but well cons.
75	+ + + + + + X X X X				
80	+ + + + + + + + X X				80–85' Sand Mod ylsh brn 10 YR 5/4, 80% v fine to fine sands, 20% thin sandstone beds (<6"). Sands are rndd, uncons, well sorted. Sandstones are of same texture, but well cons.
85	+ + + + + + + + X X				85–90' Sand Same
90	+ + + + + + + + X X				90–95' Sand Same
95	+ + + + + + + + X X				95–100' Sand Same
100	+ + + + + + + + X X				100–105' Sand Same
105	+ + + + + + + + X X				105–110' Sand Same
110	+ + + + + + + + X X				110–115' Sand Same
115	+ + + + + + + + X X				115–120' Sand Same

MW-17 Lithologic Log
(Continued)

Depth	Visual %	Lith	Drilling Time Scale:	Sample Type and Interval	Lithologic Description
115					
120	+ + + + + + + + X X				120–125' Sand Same
125					TD = 128'
130					
135					
140					
145					
150					
155					
160					
165					
170					
175					
180					

MW-18 Lithologic Log

LOCATION MAP:



__1/4 __1/4 SW 1/4 SE 1/4 S 30 T 17S R 35E

SITE ID: Phillips Lee LOCATION ID: MW-18
SITE COORDINATES (ft.):
N N4+57.74 E E1+97.40
GROUND ELEVATION (ft. MSL): 3981.1
STATE: N.M. COUNTY: Lea
DRILLING METHOD: Water Rotary
DRILLING CONTR.: Larry Felkins Drilling
DATE STARTED: 10-19-91 DATE COMPLETED: 10-21-91
FIELD REP.: K. Summers
COMMENTS:

LOCATION DESCRIPTION:

Depth	Visual %	Lith	Drilling Time Scale:	Sample Type and Interval
0	0 0 0 0 C C C C + –			
2	C C C C C C C – – +			
5	C C C C C C C – – +			
10	C C C C C C C – – +			
15	C C C C C C C – – +			
17	C C C C C C + + + +			
20	X X X X X X C C C +			
25	X X X X X C C C + +			
30	X X X X X C C C + +			
35	X X X X X X X X + C			
35	X X X X X X X X + C			
40	+ + + + + X X 0 – C			
40	+ + + + + X X 0 – C			
45	+ + + + + X X 0 – C			
50	+ + + + + + + X – C			

Lithologic Description

Interval	Description
0–2'	Clay/Caliche Clay is dk ylsh brn 10 YR 4/4 to grayish brn 5 YR 3/2, Caliche cobbles present, but not bedded. 40% clay, 40% caliche frogs, 20% silts and fine sands. Sands are sbrndd, uncons, mod well sorted w/clays.
2–5'	Caliche Mod orange pink 5 YR 8/4, cuttings are clay to pea gravel in size, 70% Cche, 20% silt, 10% v fine sands. Sands are rndd to ang, well sorted, interbedded w/Cche. Caliche well cons.
5–10'	Caliche Same
10–15'	Caliche Same
15–17'	Caliche Same
17–20'	Sandy Caliche Grayish orange 10 YR 7/4, cuttings are silt to v coarse sand sized. 40% v fine sands, 60% soft caliche. Sands are sbrndd, well sorted, uncons.
20–25'	Caliche, Sandstones Mod orange pink 5 YR 8/4, cuttings range in size from v fine sands to pea gravel. 10% v fine sands, 60% calcite cemented sandstones, 30% paleocaliche. Sandstone well rndd to sbrndd, well sorted. Sandstone is of same texture and well consolidated.
25–30'	Caliche, Sandstone Grayish orange pink 5 YR 7/2, same as above w/20% v fine sands 50% sandstone, 30% paleocaliche.
30–34'	Caliche, Sandstone Same
34–35'	Sandstone Grayish orange pink 5 YR 7/2, cuttings range from v fine sand to pea gravel size, larger cuttings are highly angular. 80% sandstone, 10% v fine sands, 10% paleocaliche. Sands are rndd to sbrndd, well sorted. Sandstones of same texture are very well consolidated, calcite cemented.
35–39'	Sandstone Same
39–40'	Sand/Sandstone Grayish orange, pink 5 YR 7/2, 50% v fine to fine sands, 20% silts and clays 20% sandstones, 10% paleocaliche. Sands are rndd to sbang, well sorted, interbedded w/sandstones and Cche.
40–45'	Sand/Sandstone Same
45–50'	Sand/Sandstone Same
50–55'	Sand/Sandstone Same but with 70% v fine to fine sands, 10% silts and clays, 10% sandstones, 10% paleocaliche.

MW-18 Lithologic Log
(Continued)

Depth	Visual %	Lith	Drilling Time Scale:	Sample Type and Interval	Lithologic Description
50					
55	+ + + + + + + X – C				55–60' <u>Sand/Sandstone</u> Same
60	+ + + + + + + + X –				60–65' <u>Sand</u> Light brn 5 YR 6/4, 80% v. fine to fine sands, <10% silts/clays, <10% thin bedded sandstones. Sands are v well rndd to sbrndd, uncons. to mod cons., well sorted.
65	+ + + + + + + + X –				65–70' <u>Sand</u> Same 70–74' <u>Sand</u> Same
70	+ + + + + X X X X X + + + + + + + + X –				74–75' <u>Sand/Sandstone</u> Lt brn 5 YR 6/4, 50% v fine to fine sands, 50% sandstone. Sands are rndd, well sorted, uncons. Sstones are of same texture, calcite cemented, well cons.
75	+ + + + + + + + X –				75–80' <u>Sand</u> Mod ylsh brn 10 YR 5/4, same as 60–65'.
80	+ + + + + + + + X –				80–85' <u>Sand</u> Same
85	+ + + + + + + + X –				85–90' <u>Sand</u> Same
90	+ + + + + + + + X –				90–95' <u>Sand</u> Same
95	+ + + + + + + + X –				95–100' <u>Sand</u> Same
100	+ + + + + + + + X –				100–105' <u>Sand</u> Same
105	+ + + + + + + + X –				105–110' <u>Sand</u> Same
110	+ + + + + + + + X –				110–115' <u>Sand</u> Same
115	+ + + + + + + + X –				115–120' <u>Sand</u> Same

MW-18 Lithologic Log
(Continued)

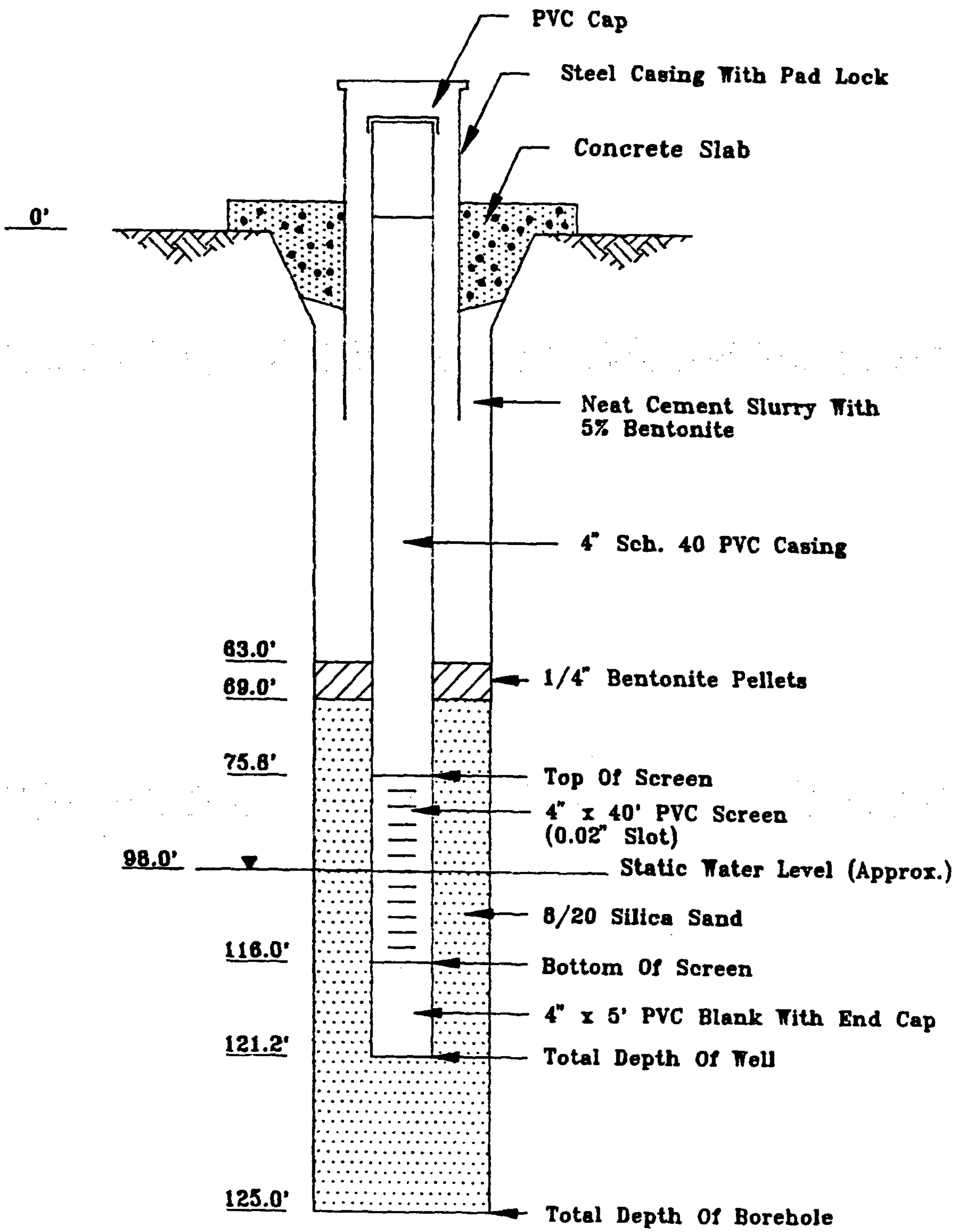
Depth	Visual %	Lith	Drilling Time Scale:	Sample Type and Interval	Lithologic Description
115					
120	+ + + + + + + + X –				120–125' Sand Same
125	+ + + + + + + + X –				125–128' Sand Same
					TD = 128'
130					
135					
140					
145					
150					
155					
160					
165					
170					
175					
180					

APPENDIX C

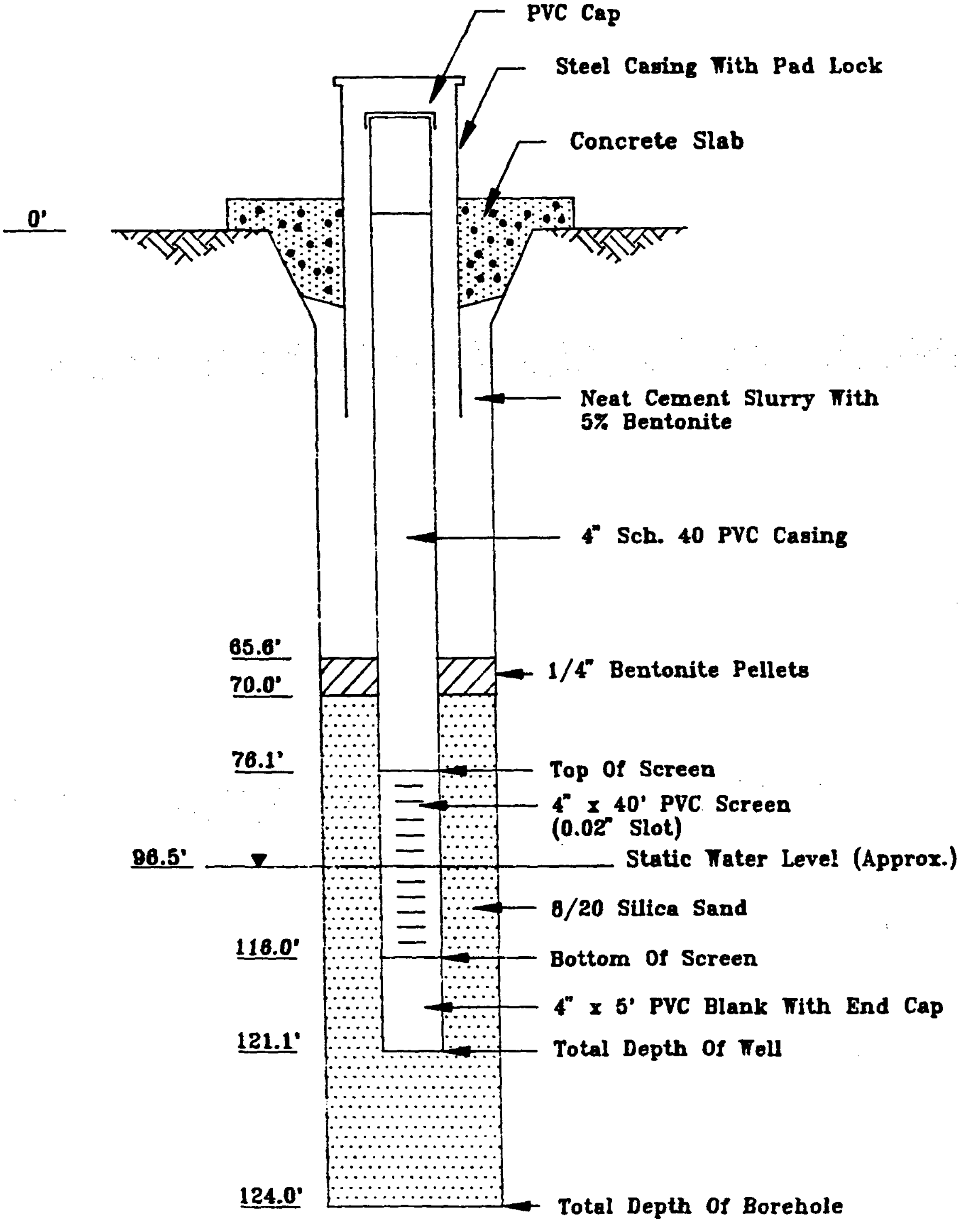
Appendix C

Monitor Well Completion Diagrams

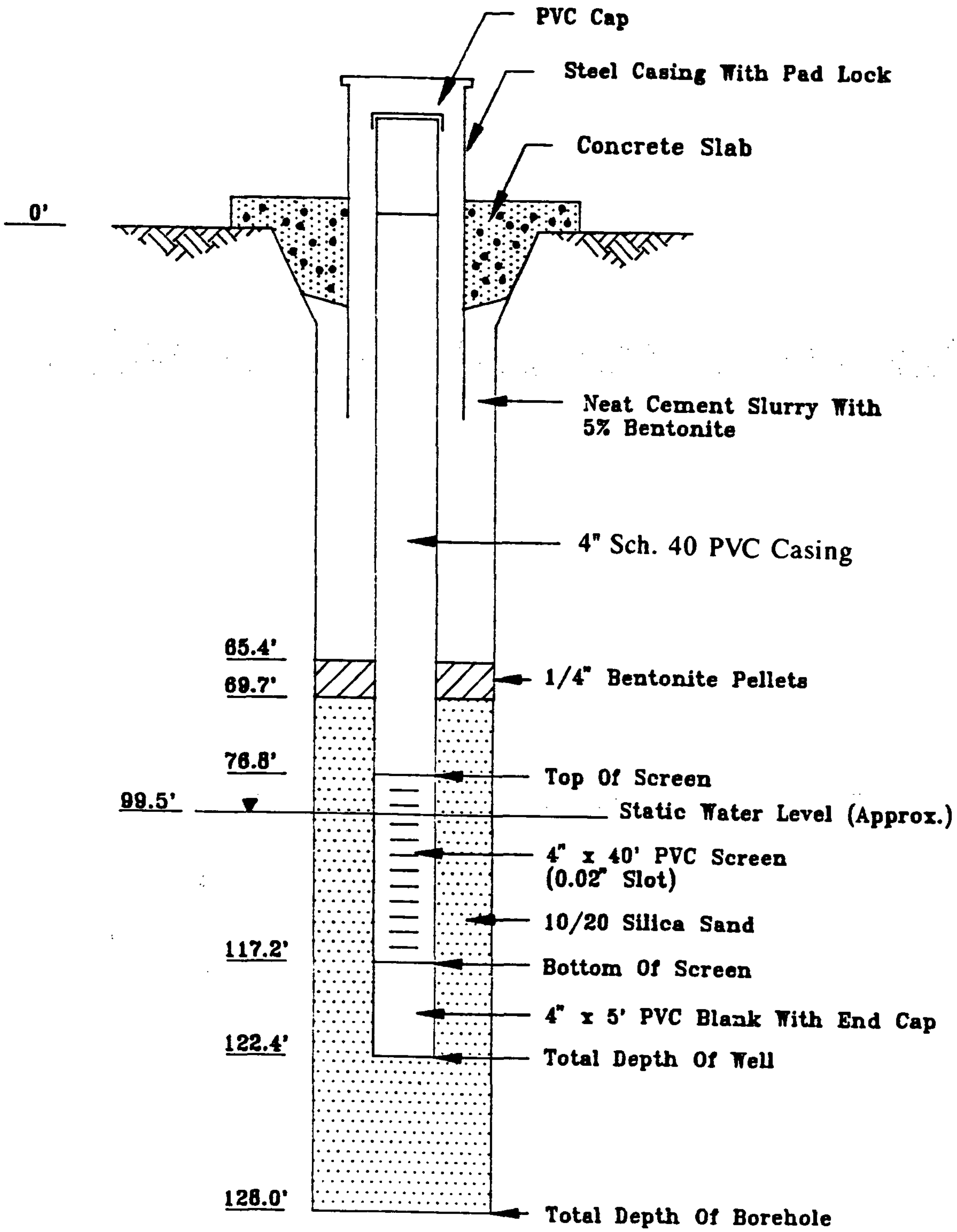
Monitor Well MW-15 Completion Diagram



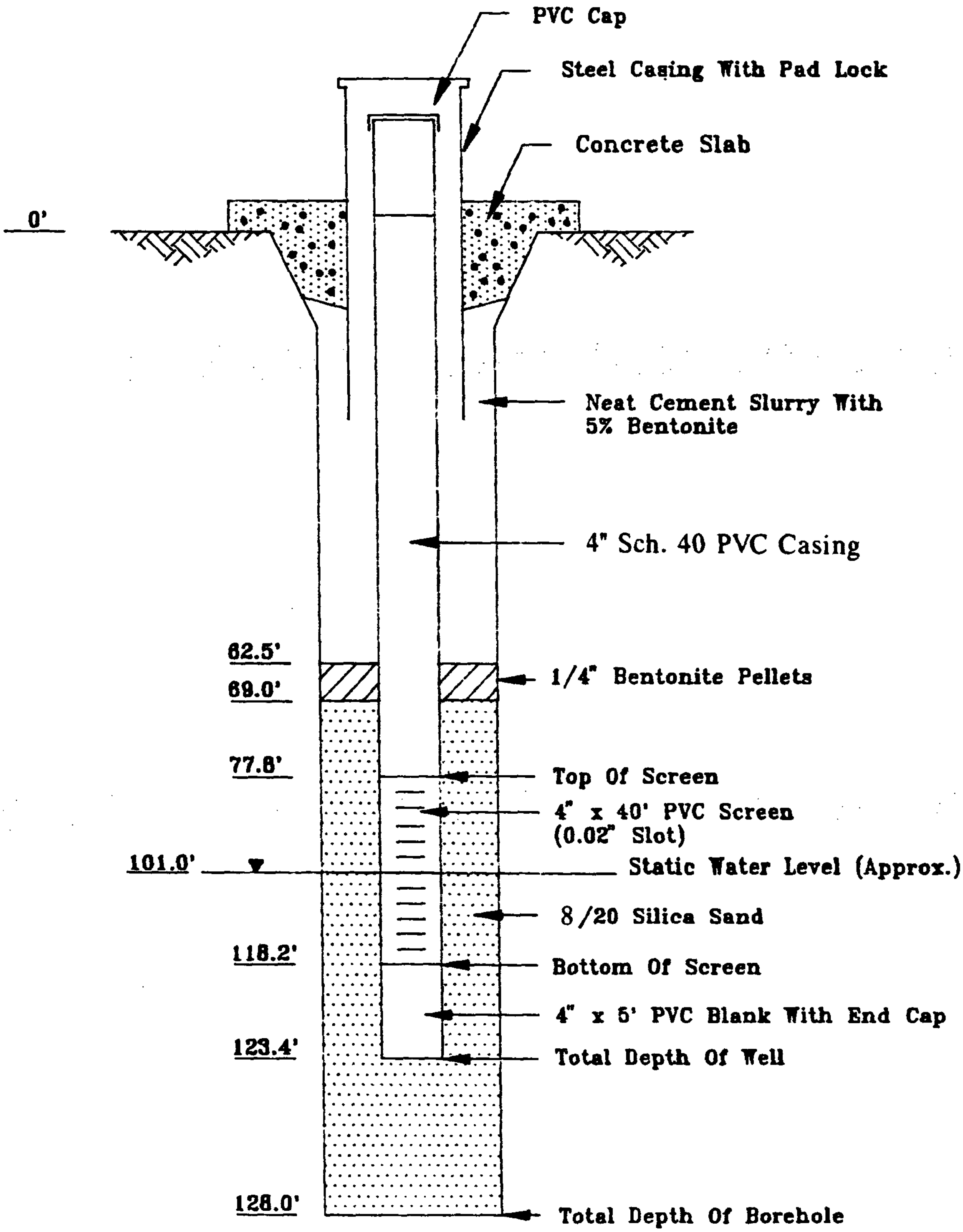
Monitor Well MW-16 Completion Diagram



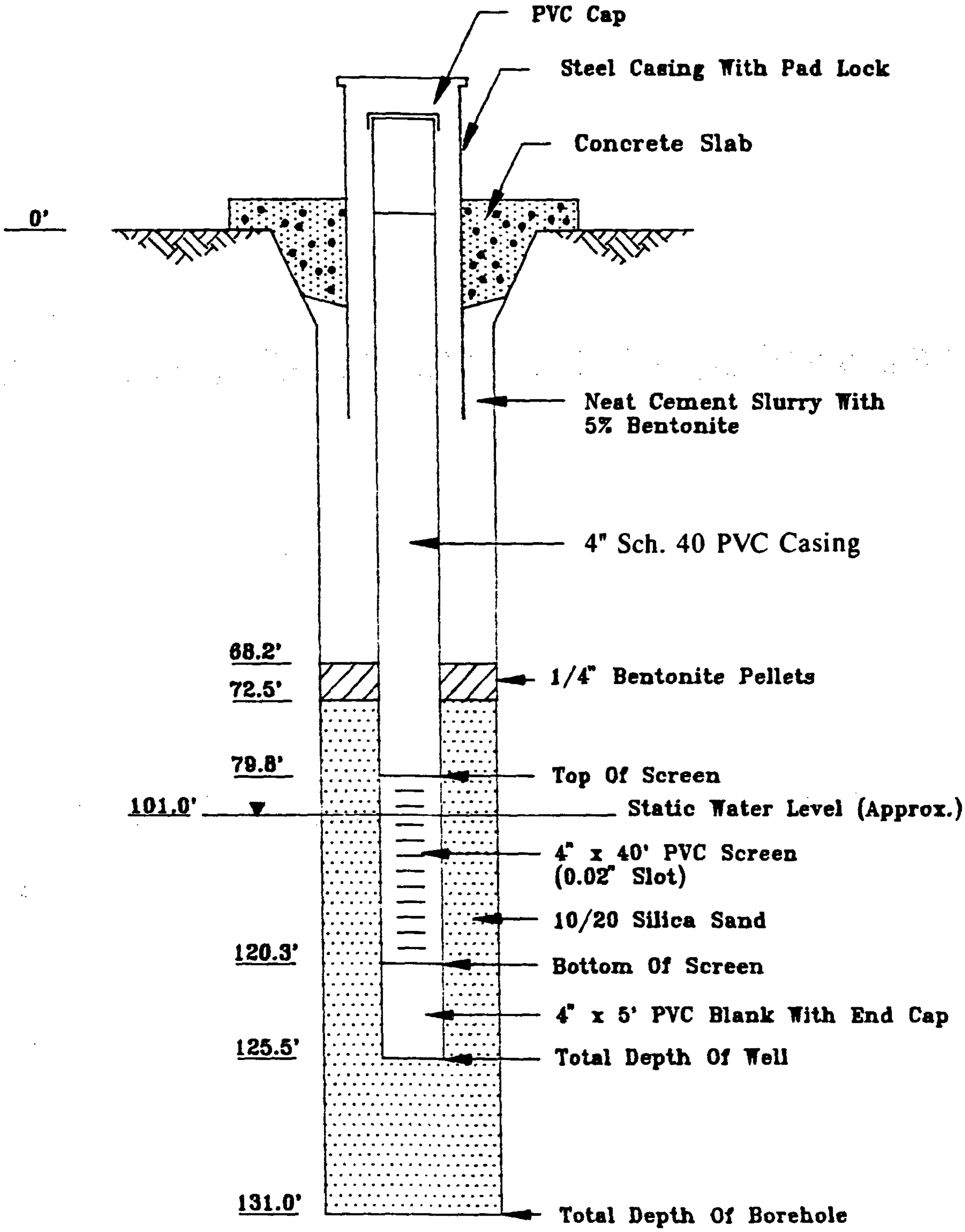
Monitor Well MW-17 Completion Diagram



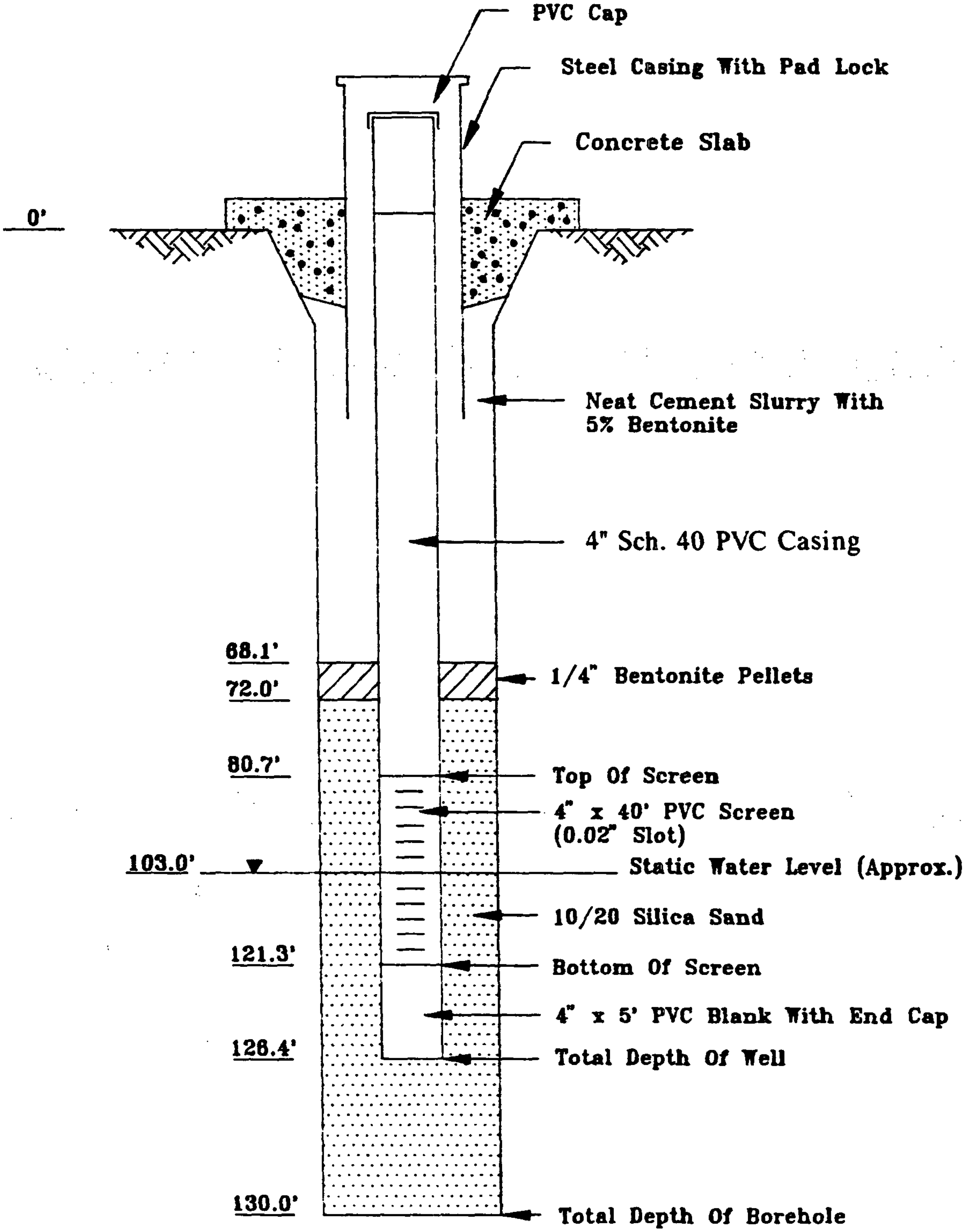
Monitor Well MW-18 Completion Diagram



Monitor Well MW-19 Completion Diagram



Monitor Well MW-20 Completion Diagram



APPENDIX D

Appendix D

Laboratory Reports

Western Atlas International

A Litton/Dresser Company

RECEIVED NOV 1 8 1991

CORE LABORATORIES

CORE LABORATORIES
ANALYTICAL REPORT

Job Number: 911982

Prepared For:

GEOSCIENCE CONSULTANTS, LTD.

500 COPPER N.W.
ALBUQUERQUE, NM 87102

Date: 11/11/91

David A. McWharter

Signature

11/12/91

Date:

Name: David A. McWharter

Title: LABORATORY MANAGER

Core Laboratories
1300 South Potomac, Suite 130
Aurora, CO 80012

GCL **Geoscience Consultants, Ltd.**

☒ Albuquerque
500 Copper N.W.
Suite 200
Albuquerque, NM 87102
(505) 842-0001

☐ East Coast
4221 Forbes Blvd.,
Suite 240
Lanham, MD 20706
(301) 459-9677

☐ Rocky Mountain
13111 E. Briarwood Ave.,
Suite 250
Englewood, CO 80112
(303) 649-9001

☐ Las Cruces
P.O. Drawer MM
Las Cruces, NM 88004
(505) 524-5364

№ 4457

Chain of Custody

DATE 10/18/91 PAGE 1 OF 1

LAB NAME CORE LABORATORIES
ADDRESS 1300 S. Potomac St. Ste 130
Aurora, CO 80012
TELEPHONE 303/751-1780

SAMPLERS (SIGNATURE) D N

ANALYSIS REQUEST: BASE/NEU/ACID CMPDS. GC/MS/ 625/8270; VOLATILE CMPDS. GC/MS/ 624/8240; PESTICIDES/PCB 608/8080; POLYNUCLEAR AROMATIC 610/8310; PHENOLS, SUB PHENOLS 604/8040; HALOGENATED VOLATILES 601/8010; AROMATIC VOLATILES 602/8020; TOTAL ORGANIC CARBON 415/9060; TOTAL ORGANIC HALIDES 9020; PETROLEUM HYDROCARBONS 418.1; TPH /BTex MODIFIED 8015; PRIORITY POLLUTANT METALS (13); CAM METALS (18) TTLC/STLC; EP TOX METALS (8); SDWA-INORGANICS PRIMARY/SECONDARY; HAZARDOUS WASTE PROFILE; NUMBER OF CONTAINERS

SAMPLE NUMBER	MATRIX	LOCATION
9110170905	H_2O	mw 11
9110171100	H_2O	mw12
9110171230	H_2O	mw13
9110171240	H_2O	~~Rinsate blank~~
9110171245	H_2O	~~Field Blank~~
9110171425	H_2O	mw 14
9110171545	H_2O	mw 9
9110171700	H_2O	~~mw9A~~
9110181300	H_2O	mw 16

PROJECT INFORMATION
PROJECT: PHILLIPS
PROJECT DIRECTOR M. Nee
CHARGE CODE NO.
SHIPPING ID NO. 0254123671
VIA: Fed X

SAMPLE RECEIPT

TOTAL NO. OF CONTAINERS	27
CHAIN OF CUSTODY SEALS	yes
REC'D GOOD CONDITION/COLD	y/c
CONFORMS TO RECORD	NA

LAB NO. 911982

RELINQUISHED BY 1.
D L 1700
(Signature) (Time)
DAVID NEE 10/18
(Printed Name) (Date)
GCL
(Company)

RELINQUISHED BY 2.
(Signature) (Time)
(Printed Name) (Date)
(Company)

RELINQUISHED BY 3.
(Signature) (Time)
(Printed Name) (Date)
(Company)

RECEIVED BY 1.
(Signature) (Time)
(Printed Name) (Date)
(Company)

RECEIVED BY 2.
(Signature) (Time)
(Printed Name) (Date)
(Company)

RECEIVED BY (LABORATORY) 3.
Darryl Ng-A-Qui 10:00
(Signature) (Time)
DARRYL NG-A-QUI 10-21-9
(Printed Name) DATE
CORE LABORATORIES
ANALYTI

SPECIAL INSTRUCTIONS/COMMENTS:

DISTRIBUTION: WHITE, CANARY - LABORATORY • PINK - GEOSCIENCE CONSULTANTS, LTD.

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CORE LABORATORIES

LABORATORY TESTS RESULTS
11/11/91

JOB NUMBER: 911982 CUSTOMER: GEOSCIENCE CONSULTANTS, LTD. ATTN:

CLIENT I.D.........: PHILLIPS COC #4457
DATE SAMPLED.......: 10/17/91
TIME SAMPLED.......: 09:05
WORK DESCRIPTION...: 9110170905

LABORATORY I.D...: 911982-0001
DATE RECEIVED....: 10/21/91
TIME RECEIVED....: 10:00
REMARKS..........:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	10/30/91	MRC
Benzene	2	1	ug/L			
Toluene	2	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			
8015(Mod) - Hydrocarbon ID - TPH	<10	10	mg/L Diesel	8015 (Modified) (2)	10/29/91	MRC

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

LABORATORY TESTS RESULTS

11/11/91

JOB NUMBER: 911982 CUSTOMER: GEOSCIENCE CONSULTANTS, LTD. ATTN:

CLIENT I.D.........: PHILLIPS COC #4457
DATE SAMPLED.......: 10/17/91
TIME SAMPLED.......: 11:00
WORK DESCRIPTION...: 9110171100

LABORATORY I.D...: 911982-0002
DATE RECEIVED....: 10/21/91
TIME RECEIVED....: 10:00
REMARKS..........:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	10/30/91	MRC
Benzene	4	1	ug/L			
Toluene	3	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			
8015(Mod) - Hydrocarbon ID - TPH	<10	10	mg/L Diesel	8015 (Modified) (2)	10/29/91	MRC

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LABORATORY TESTS RESULTS
11/11/91

JOB NUMBER: 911982 CUSTOMER: GEOSCIENCE CONSULTANTS, LTD. ATTN:

CLIENT I.D.........: PHILLIPS COC #4457
DATE SAMPLED.......: 10/17/91
TIME SAMPLED.......: 12:30
WORK DESCRIPTION...: 9110171230

LABORATORY I.D...: 911982-0003
DATE RECEIVED....: 10/21/91
TIME RECEIVED....: 10:00
REMARKS..........:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	10/30/91	MRC
Benzene	1	1	ug/L			
Toluene	1	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			
8015(Mod) - Hydrocarbon ID - TPH	<10	10	mg/L Diesel	8015 (Modified) (2)	10/29/91	MRC

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LABORATORY TESTS RESULTS
11/11/91

JOB NUMBER: 911982 CUSTOMER: GEOSCIENCE CONSULTANTS, LTD. ATTN:

CLIENT I.D.........: PHILLIPS COC #4457
DATE SAMPLED.......: 10/17/91
TIME SAMPLED.......: 12:40
WORK DESCRIPTION...: 9110171240

LABORATORY I.D...: 911982-0004
DATE RECEIVED....: 10/21/91
TIME RECEIVED....: 10:00
REMARKS..........:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	10/30/91	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			
8015(Mod) - Hydrocarbon ID - TPH	<10	10	mg/L Diesel	8015 (Modified) (2)	10/29/91	MRC

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LABORATORY TESTS RESULTS
11/11/91

JOB NUMBER: 911982 CUSTOMER: GEOSCIENCE CONSULTANTS, LTD. ATTN:

CLIENT I.D.........: PHILLIPS COC #4457
DATE SAMPLED.......: 10/17/91
TIME SAMPLED.......: 12:45
WORK DESCRIPTION...: 9110171245

LABORATORY I.D...: 911982-0005
DATE RECEIVED....: 10/21/91
TIME RECEIVED....: 10:00
REMARKS..........:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	10/30/91	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			
8015(Mod) - Hydrocarbon ID - TPH	<10	10	mg/L Diesel	8015 (Modified) (2)	10/29/91	MRC

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JOB NUMBER: 911982 CUSTOMER: GEOSCIENCE CONSULTANTS, LTD. ATTN:

CLIENT I.D.........: PHILLIPS COC #4457
DATE SAMPLED.......: 10/17/91
TIME SAMPLED.......: 14:25
WORK DESCRIPTION...: 9110171425

LABORATORY I.D...: 911982-0006
DATE RECEIVED....: 10/21/91
TIME RECEIVED....: 10:00
REMARKS..........:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	10/30/91	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			
8015(Mod) - Hydrocarbon ID - TPH	<10	10	mg/L Diesel	8015 (Modified) (2)	10/29/91	MRC

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LABORATORY TESTS RESULTS
11/11/91

JOB NUMBER: 911982 CUSTOMER: GEOSCIENCE CONSULTANTS, LTD. ATTN:

CLIENT I.D.........: PHILLIPS COC #4457
DATE SAMPLED.......: 10/17/91
TIME SAMPLED.......: 15:45
WORK DESCRIPTION...: 9110171545

LABORATORY I.D...: 911982-0007
DATE RECEIVED....: 10/21/91
TIME RECEIVED....: 10:00
REMARKS..........:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	10/30/91	MRC
Benzene	2	1	ug/L			
Toluene	3	1	ug/L			
Ethyl Benzene	2	1	ug/L			
Xylenes	ND	1	ug/L			
8015(Mod) - Hydrocarbon ID - TPH	<10	10	mg/L Diesel	8015 (Modified) (2)	10/29/91	MRC

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LABORATORY TESTS RESULTS

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JOB NUMBER: 911982 CUSTOMER: GEOSCIENCE CONSULTANTS, LTD. ATTN:

CLIENT I.D.........: PHILLIPS COC #4457
DATE SAMPLED.......: 10/17/91
TIME SAMPLED.......: 17:00
WORK DESCRIPTION...: 9110171700

LABORATORY I.D...: 911982-0008
DATE RECEIVED....: 10/21/91
TIME RECEIVED....: 10:00
REMARKS..........:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	10/30/91	MRC
Benzene	2	1	ug/L			
Toluene	4	1	ug/L			
Ethyl Benzene	2	1	ug/L			
Xylenes	ND	1	ug/L			
8015(Mod) - Hydrocarbon ID - TPH	<10	10	mg/L Diesel	8015 (Modified) (2)	10/29/91	MRC

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11/11/91

JOB NUMBER: 911982   CUSTOMER: GEOSCIENCE CONSULTANTS, LTD.   ATTN:

CLIENT I.D.........: PHILLIPS COC #4457
DATE SAMPLED.......: 10/18/91
TIME SAMPLED.......: 13:00
WORK DESCRIPTION...: 9110181300

LABORATORY I.D...: 911982-0009
DATE RECEIVED....: 10/21/91
TIME RECEIVED....: 10:00
REMARKS..........:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	10/30/91	MRC
Benzene	4	1	ug/L			
Toluene	2	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			
8015(Mod) - Hydrocarbon ID - TPH	<10	10	mg/L Diesel	8015 (Modified) (2)	10/29/91	MRC

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CORE LABORATORIES

CORE LABORATORIES
A N A L Y T I C A L   R E P O R T

Job Number: 912075
Prepared For:

GEOSCIENCE CONSULTANTS, LTD.

505 MARQUETTE AVE. N.W.
ALBUQUERQUE, NM 87102

Date: 11/27/91

Signature

Date: 11/27/91

Name: David A. McWharter

Title: LABORATORY MANAGER

Core Laboratories
1300 South Potomac, Suite 130
Aurora, CO 80012

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☐ Rocky Mountain
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(303) 649-9001

☐ Las Cruces
P.O. Drawer MM
Las Cruces, NM 88004
(505) 524-5364

№ 4456

Chain of Custody

DATE 10-30 PAGE 1 OF 1

LAB NAME CORE LABORATORIES
ADDRESS 1300 S. Potomac St. Ste 130
Aurora, CO 80012
TELEPHONE 303/751-1780

SAMPLERS (SIGNATURE) [signature]

ANALYSIS REQUEST

SAMPLE NUMBER	MATRIX	LOCATION	BASE/NEU/ACID CMPDS. GC/MS/ 625/8270	VOLATILE CMPDS. GC/MS/ 624/8240	PESTICIDES/PCB 608/8080	POLYNUCLEAR AROMATIC 610/8310	PHENOLS, SUB PHENOLS 604/8040	HALOGENATED VOLATILES 601/8010	AROMATIC VOLATILES 602/8020	TOTAL ORGANIC CARBON 415/9060	TOTAL ORGANIC HALIDES 9020	PETROLEUM HYDROCARBONS 418.1	TPH MODIFIED 8015	BTEX/TPH	PRIORITY POLLUTANT METALS (13)	CAM METALS (18) TTLC/STLC	EP TOX METALS (8)	SDWA-INORGANICS PRIMARY/SECONDARY'	HAZARDOUS WASTE PROFILE				NUMBER OF CONTAINERS
9110291745	H_2O	MW-20												3									3
9110271450	H_2O	MW-17												3									3
9110291140	H_2O	MW-15												3									3
9110280510	H_2O	MW-18												3									3
9110252330	H_2O	MW-19												3									3
9110300700	H_2O													1									1

PROJECT INFORMATION

PROJECT: Phillips
PROJECT DIRECTOR H Jolke
CHARGE CODE NO. 523-000
SHIPPING ID. NO. 025442 3584
VIA: FedEx

SAMPLE RECEIPT

TOTAL NO. OF CONTAINERS	16
CHAIN OF CUSTODY SEALS	yes
REC'D GOOD CONDITION/COLD	yes
CONFORMS TO RECORD	yes

LAB NO. 912075

RELINQUISHED BY 1.	RELINQUISHED BY 2.	RELINQUISHED BY 3.
[signature] 0800 (Signature) (Time)	(Signature) (Time)	(Signature) (Time)
KYLE SUMMERS 10/30 (Printed Name) (Date)	(Printed Name) (Date)	(Printed Name) (Date)
GCL (Company)	(Company)	(Company)

RECEIVED BY 1.	RECEIVED BY 2.	RECEIVED BY (LABORATORY) 3.
(Signature) (Time)	(Signature) (Time)	[signature] 10:25 (Signature) (Time)
(Printed Name) (Date)	(Printed Name) (Date)	DARRYL NAKAGUI 11-1-91 (Printed Name) DATE
(Company)	(Company)	CORE LABORATORIES ANALYTI

SPECIAL INSTRUCTIONS/COMMENTS:
See David Marshall for specifics

DISTRIBUTION: WHITE, CANARY - LABORATORY • PINK - GEOSCIENCE CONSULTANTS, LTD.

Western Atlas International

CORE LABORATORIES

LABORATORY TESTS RESULTS
11/27/91

JOB NUMBER: 912075 CUSTOMER: GEOSCIENCE CONSULTANTS, LTD. ATTN:

CLIENT I.D.........: PHILLIPS COC #4456
DATE SAMPLED.......: 10/29/91
TIME SAMPLED.......: 17:45
WORK DESCRIPTION...: 9110291745

LABORATORY I.D...: 912075-0001
DATE RECEIVED....: 11/01/91
TIME RECEIVED....: 10:25
REMARKS..........:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	11/04/91	MRC
Benzene	80	1	ug/L			
Toluene	41	1	ug/L			
Ethyl Benzene	3	1	ug/L			
Xylenes	3	1	ug/L			
8015(Mod) - Hydrocarbon ID - TPH	<10	10	mg/L Diesel	8015 (Modified) (2)	11/15/91	MRC

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

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CORE LABORATORIES

L A B O R A T O R Y   T E S T S   R E S U L T S
11/27/91

JOB NUMBER: 912075   CUSTOMER: GEOSCIENCE CONSULTANTS, LTD.   ATTN:

CLIENT I.D.........: PHILLIPS COC #4456
DATE SAMPLED.......: 10/27/91
TIME SAMPLED.......: 14:50
WORK DESCRIPTION...: 9110271450

LABORATORY I.D...: 912075-0002
DATE RECEIVED....: 11/01/91
TIME RECEIVED....: 10:25
REMARKS..........:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	11/04/91	MRC
Benzene	8	1	ug/L			
Toluene	2	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			
8015(Mod) - Hydrocarbon ID - TPH	<10	10	mg/L Diesel	8015 (Modified) (2)	11/15/91	MRC

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

Western Atlas International

CORE LABORATORIES

LABORATORY TESTS RESULTS
11/27/91

JOB NUMBER: 912075 CUSTOMER: GEOSCIENCE CONSULTANTS, LTD. ATTN:

CLIENT I.D.........: PHILLIPS COC #4456
DATE SAMPLED.......: 10/29/91
TIME SAMPLED.......: 11:40
WORK DESCRIPTION...: 9110291140

LABORATORY I.D...: 912075-0003
DATE RECEIVED....: 11/01/91
TIME RECEIVED....: 10:25
REMARKS..........:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
8020 - AROMATIC VOLATILE ORGANICS		*50		8020 (2)	11/05/91	MRC
Benzene	4200	50	ug/L			
Toluene	450	50	ug/L			
Ethyl Benzene	100	50	ug/L			
Xylenes	100	50	ug/L			
8015(Mod) - Hydrocarbon ID - TPH	<10	10	mg/L Diesel	8015 (Modified) (2)	11/15/91	MRC

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CORE LABORATORIES

LABORATORY TESTS RESULTS
11/27/91

2075 CUSTOMER: GEOSCIENCE CONSULTANTS, LTD. ATTN:

....: PHILLIPS COC #4456
....: 10/28/91
....: 05:10
ON...: 9110280510

LABORATORY I.D...: 912075-0004
DATE RECEIVED....: 11/01/91
TIME RECEIVED....: 10:25
REMARKS..........:

	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
C VOLATILE ORGANICS		*1		8020 (2)	11/04/91	MRC
	ND	1	ug/L			
	1	1	ug/L			
ene	ND	1	ug/L			
	ND	1	ug/L			
carbon ID - TPH	<10	10	mg/L Diesel	8015 (Modified) (2)	11/15/91	MRC

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CORE LABORATORIES

LABORATORY TESTS RESULTS
11/27/91

JOB NUMBER: 912075 CUSTOMER: GEOSCIENCE CONSULTANTS, LTD. ATTN:

CLIENT I.D.........: PHILLIPS COC #4456
DATE SAMPLED.......: 10/25/91
TIME SAMPLED.......: 23:30
WORK DESCRIPTION...: 9110252330

LABORATORY I.D...: 912075-0005
DATE RECEIVED....: 11/01/91
TIME RECEIVED....: 10:25
REMARKS..........: SMALL BUBBLE IN 2*HCL VOA

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	11/04/91	MRC
Benzene	ND	1	ug/L			
Toluene	1	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			
8015(Mod) - Hydrocarbon ID - TPH	<10	10	mg/L Diesel	8015 (Modified) (2)	11/15/91	MRC

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CORE LABORATORIES

LABORATORY TESTS RESULTS
11/27/91

JOB NUMBER: 912075   CUSTOMER: GEOSCIENCE CONSULTANTS, LTD.   ATTN:

CLIENT I.D.........: PHILLIPS COC #4456
DATE SAMPLED.......: 10/30/91
TIME SAMPLED.......: 07:00
WORK DESCRIPTION...: 9110300700

LABORATORY I.D...: 912075-0006
DATE RECEIVED....: 11/01/91
TIME RECEIVED....: 10:25
REMARKS..........: BUBBLE IN VOA

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
8020 - AROMATIC VOLATILE ORGANICS		*1		8020 (2)	11/04/91	MRC
Benzene	ND	1	ug/L			
Toluene	ND	1	ug/L			
Ethyl Benzene	ND	1	ug/L			
Xylenes	ND	1	ug/L			

1300 South Potomac, Suite 130
Aurora, CO 80012
(303) 751-1780

Geoscience Consultants, Ltd.

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500 Copper N.W.
Suite 200
Albuquerque, NM 87102
(505) 842-0001

☐ East Coast
4221 Forbes Blvd.,
Suite 240
Lanham, MD 20706
(301) 459-9677

☐ Rocky Mountain
13111 E. Briarwood Ave.,
Suite 250
Englewood, CO 80112
(303) 649-9001

☐ Las Cruces
P.O. Drawer MM
Las Cruces, NM 88004
(505) 524-5364

№ 4456

Chain of Custody

DATE 10-30 PAGE 1 OF 1

LAB NAME: CORE LABORATORIES
ADDRESS: 1300 S. Potomac St. Ste 130
Aurora, CO 80012
TELEPHONE: 303/751-1780

SAMPLERS (SIGNATURE): [signature]

ANALYSIS REQUEST

SAMPLE NUMBER	MATRIX	LOCATION	BASE/NEU/ACID CMPDS. GC/MS/ 625/8270	VOLATILE CMPDS. GC/MS/ 624/8240	PESTICIDES/PCB 608/8080	POLYNUCLEAR AROMATIC 610/8310	PHENOLS, SUB PHENOLS 604/8040	HALOGENATED VOLATILES 601/8010	AROMATIC VOLATILES 602/8020	TOTAL ORGANIC CARBON 415/9060	TOTAL ORGANIC HALIDES 9020	PETROLEUM HYDROCARBONS 418.1	TPH MODIFIED 8015	BTEX/TPH	PRIORITY POLLUTANT METALS (13)	CAM METALS (18) TTLC/STLC	EP TOX METALS (8)	SDWA-INORGANICS PRIMARY/SECONDARY	HAZARDOUS WASTE PROFILE				NUMBER OF CONTAINERS
9110291745	H_2O	MW-20												3									3
9110271450	H_2O	MW-17												3									3
9110291140	H_2O	MW-15												3									3
9110280510	H_2O	MW-18												3									3
9110252330	H_2O	MW-19												3									3
9110300~~700~~	~~H_2O~~													1									1

PROJECT INFORMATION	
PROJECT:	Phillips
PROJECT DIRECTOR	H. Jelke
CHARGE CODE NO.	528-000
SHIPPING ID. NO.	025442 3584
VIA:	FedEx

SAMPLE RECEIPT	
TOTAL NO. OF CONTAINERS	16
CHAIN OF CUSTODY SEALS	yes
REC'D GOOD CONDITION/COLD	yes
CONFORMS TO RECORD	yes
LAB NO.	912075

SPECIAL INSTRUCTIONS/COMMENTS:
See David Marshall for Specifics

RELINQUISHED BY 1.	RELINQUISHED BY 2.	RELINQUISHED BY 3.
[signature] (Signature) 0800 (Time)	(Signature) (Time)	(Signature) (Time)
KYLE SUMMERS (Printed Name) 10/30 (Date)	(Printed Name) (Date)	(Printed Name) (Date)
GCL (Company)	(Company)	(Company)

RECEIVED BY 1.	RECEIVED BY 2.	RECEIVED BY (LABORATORY) 3.
(Signature) (Time)	(Signature) (Time)	[signature] (Signature) 10:25 (Time)
(Printed Name) (Date)	(Printed Name) (Date)	DARRYL NU-A-OUI (Printed Name) 11-1-91 DATE
(Company)	(Company)	CORE LABORATORIES ANALYTI

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Farmington, New Mexico 87401

RECEIVED DEC 1 2 1991

CLIENT:	Geoscience Consultants	DATE REPORTED:	12/11/91
ID:	1745		
SITE:	MW-20	DATE RECEIVED:	11/01/91
LAB NO:	F7595	DATE COLLECTED:	10/29/91

Lab pH (s.u.)	7.15
Lab conductivity, umhos/cm	431
Lab resistivity, ohm-m	23.2
Total dissolved solids (180), mg/L	312
Total dissolved solids (calc), mg/L	223
Total alkalinity as CaC03, mg/L	124
Total hardness as CaC03, mg/L	153
Sodium adsorption ratio	0.87
Fluoride, mg/L	0.70
Nitrate, mg/L	2.55
Nitrite, mg/L	<0.02

	mg/L	meq/L
Bicarbonate as HC03	152	2.49
Carbonate as C03	0	0
Chloride	29.8	0.84
Sulfate	32.9	0.69
Calcium	55.9	2.79
Magnesium	3.25	0.27
Potassium	2.1	0.05
Sodium	24.7	1.07
Major cations		4.19
Major anions		4.20
Cation/anion difference		0.14 %

Mary Stepp
Mary Stepp
Lab Director

Wanda Orso
Wanda Orso
Water Lab Supervisor

2506 W. Main Street
Farmington, New Mexico 87401

CLIENT:	Geoscience Consultants	DATE REPORTED:	12/11/91
ID:	1450		
SITE:	MW-17	DATE RECEIVED:	11/01/91
LAB NO:	F7596	DATE COLLECTED:	10/27/91

Lab pH (s.u.)	7.17
Lab conductivity, umhos/cm	1200
Lab resistivity, ohm-m	8.33
Total dissolved solids (180), mg/L	538
Total dissolved solids (calc), mg/L	503
Total alkalinity as CaC03, mg/L	277
Total hardness as CaC03, mg/L	378
Sodium adsorption ratio	0.89
Fluoride, mg/L	0.35
Nitrate, mg/L	<0.02
Nitrite, mg/L	<0.02

	mg/L	meq/L
Bicarbonate as HC03	338	5.54
Carbonate as C03	0	0
Chloride	116	3.26
Sulfate	32.1	0.67
Calcium	130	6.5
Magnesium	13	1.07
Potassium	6.1	0.16
Sodium	39.6	1.72
Major cations		9.45
Major anions		9.46
Cation/anion difference		0.09 %

Mary Stepp

Mary Stepp
Lab Director

Wanda Orso

Wanda Orso
Water Lab Supervisor

Inter-Mountain Laboratories, Inc.

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Farmington, New Mexico 87401

CLIENT:	Geoscience Consultants	DATE REPORTED:	12/11/91
ID:	1140		
SITE:	MW-15	DATE RECEIVED:	11/01/91
LAB NO:	F7597	DATE COLLECTED:	10/29/91

Lab pH (s.u.)........................	7.24
Lab conductivity, umhos/cm..........	1560
Lab resistivity, ohm-m..............	6.41
Total dissolved solids (180), mg/L..	780
Total dissolved solids (calc), mg/L.	659
Total alkalinity as CaC03, mg/L.....	338
Total hardness as CaC03, mg/L.......	515
Sodium adsorption ratio.............	0.88
Fluoride, mg/L......................	0.57
Nitrate, mg/L.......................	<0.02
Nitrite, mg/L.......................	<0.02

	mg/L	meq/L
Bicarbonate as HC03.......	413	6.77
Carbonate as C03..........	0	0
Chloride..................	194	5.48
Sulfate...................	14.6	0.3
Calcium...................	182	9.08
Magnesium.................	14.9	1.22
Potassium.................	4.6	0.12
Sodium....................	45.8	1.99
Major cations......................		12.4
Major anions.......................		12.5
Cation/anion difference............		0.57 %

Mary Stepp
Mary Stepp
Lab Director

Wanda Orso
Wanda Orso
Water Lab Supervisor

2506 W. Main Street
Farmington, New Mexico 87401

CLIENT:	Geoscience Consultants	DATE REPORTED:	12/11/91
ID:	0510		
SITE:	MW-18	DATE RECEIVED:	11/01/91
LAB NO:	F7598	DATE COLLECTED:	10/28/91

Lab pH (s.u.)	7.20
Lab conductivity, umhos/cm	435
Lab resistivity, ohm-m	23
Total dissolved solids (180), mg/L	286
Total dissolved solids (calc), mg/L	245
Total alkalinity as CaC03, mg/L	137
Total hardness as CaC03, mg/L	172
Sodium adsorption ratio	0.66
Fluoride, mg/L	0.70
Nitrate, mg/L	<0.02
Nitrite, mg/L	<0.02

	mg/L	meq/L
Bicarbonate as HC03	167	2.74
Carbonate as C03	0	0
Chloride	21.9	0.62
Sulfate	48.6	1.01
Calcium	67.7	3.38
Magnesium	0.87	0.07
Potassium	3.6	0.09
Sodium	19.9	0.87
Major cations		4.41
Major anions		4.38
Cation/anion difference		0.34 %

Mary Stepp
Mary Stepp
Lab Director

Wanda Orso
Wanda Orso
Water Lab Supervisor

2506 W. Main Street
Farmington, New Mexico 87401

CLIENT:	Geoscience Consultants	DATE REPORTED:	12/11/91
ID:	2330		
SITE:	MW-19	DATE RECEIVED:	11/01/91
LAB NO:	F7599	DATE COLLECTED:	10/25/91

Lab pH (s.u.)........................	7.33
Lab conductivity, umhos/cm..........	1490
Lab resistivity, ohm-m..............	6.72
Total dissolved solids (180), mg/L..	722
Total dissolved solids (calc), mg/L.	689
Total alkalinity as CaC03, mg/L.....	401
Total hardness as CaC03, mg/L.......	465
Sodium adsorption ratio.............	1.63
Fluoride, mg/L......................	0.32
Nitrate, mg/L.......................	2.73
Nitrite, mg/L.......................	<0.02

	mg/L	meq/L
Bicarbonate as HC03.......	489	8.02
Carbonate as C03..........	0	0
Chloride..................	150	4.22
Sulfate...................	39.5	0.82
Calcium...................	153	7.62
Magnesium.................	20.4	1.68
Potassium.................	5.2	0.13
Sodium....................	80.7	3.51
Major cations......................		12.9
Major anions.......................		13.3
Cation/anion difference............		1.21 %

Mary Stepp
Mary Stepp
Lab Director

Wanda Orso
Wanda Orso
Water Lab Supervisor

Inter-Mountain Laboratories, Inc.

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Farmington, New Mexico 87401

CLIENT:	Geoscience Consultants	DATE REPORTED:	12/11/91
ID:	WM -18		
SITE:	Lab Split	DATE RECEIVED:	11/01/91
LAB NO:	F7600	DATE COLLECTED:	10/28/91

Lab pH (s.u.)	7.40
Lab conductivity, umhos/cm	428
Lab resistivity, ohm-m	23.4
Total dissolved solids (180), mg/L	298
Total dissolved solids (calc), mg/L	250
Total alkalinity as CaC03, mg/L	144
Total hardness as CaC03, mg/L	173
Sodium adsorption ratio	0.69
Fluoride, mg/L	0.67
Nitrate, mg/L	0.06
Nitrite, mg/L	<0.02

	mg/L	meq/L
Bicarbonate as HC03	175	2.87
Carbonate as C03	0	0
Chloride	23	0.65
Sulfate	47.8	1
Calcium	67.8	3.38
Magnesium	1.01	0.08
Potassium	3.6	0.09
Sodium	20.9	0.91
Major cations		4.47
Major anions		4.52
Cation/anion difference		0.58 %

Mary Stepp

Mary Stepp
Lab Director

Wanda Orso

Wanda Orso
Water Lab Supervisor

GCL

Geoscience Consultants, Ltd.

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Suite 706
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(301) 587-2088

☐ Newport Beach
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Newport Beach, CA 92660
(714) 724-0536

☐ Las Cruces
P.O. Drawer MM
Las Cruces, NM 88004
(505) 524-5364

2616

Chain of Custody

DATE 10-30 PAGE 1 OF ____

LAB NAME InterMountain Laboratories
ADDRESS 2506 West Main Street
Farmington, NM 87401
TELEPHONE 505/326-4737

SAMPLERS (SIGNATURE) [signature]

ANALYSIS REQUEST

SAMPLE NUMBER	MATRIX	LOCATION	BASE/NEU/ACID CMPDS. GC/MS/ 625/8270	VOLATILE CMPDS. GC/MS/ 624/8240	PESTICIDES/PCB 608/8080	POLYNUCLEAR AROMATIC 610/8310	PHENOLS, SUB PHENOLS 604/8040	HALOGENATED VOLATILES 601/8010	AROMATIC VOLATILES 602/8020	TOTAL ORGANIC CARBON 415/9060	TOTAL ORGANIC HALIDES 9020	PETROLEUM HYDROCARBONS 418.1	TPH MODIFIED 8015	General Chemistry	PRIORITY POLLUTANT METALS (13)	CAM METALS (18) TTLC/STLC	EP TOX METALS (8)	SDWA-INORGANICS PRIMARY/SECONDARY	HAZARDOUS WASTE PROFILE	Major Ions [illegible]			NUMBER OF CONTAINERS
9110291745	H_2O	MW-20												1						1			2
9110271450	H_2O	MW-17												1						1			2
9110291140	H_2O	MW-15												1						1			2
9110280510	H_2O	MW-18												1						1			2
9110252330	H_2O	MW-19												1						1			2

PROJECT INFORMATION

PROJECT: Phillips
PROJECT DIRECTOR: M. Selke
CHARGE CODE NO. 523-000
SHIPPING ID. NO. 9223344056
VIA: Fed X

SAMPLE RECEIPT

TOTAL NO. OF CONTAINERS	
CHAIN OF CUSTODY SEALS	
REC'D GOOD CONDITION/COLD	
CONFORMS TO RECORD	

LAB NO.

SPECIAL INSTRUCTIONS/COMMENTS: Gen. Chem., Major Ions, pH, Conductivity, Ion Balance.

RELINQUISHED BY 1.
(Signature) [signature] (Time) 0800
(Printed Name) KYLE SUMMERS (Date) 10/30
(Company) GCL

RELINQUISHED BY 2.
(Signature) (Time)
(Printed Name) (Date)
(Company)

RELINQUISHED BY 3.
(Signature) (Time)
(Printed Name) (Date)
(Company)

RECEIVED BY 1.
(Signature) [signature] (Time) 11:00
(Printed Name) [illegible] Glass (Date) 11-1
(Company) IML

RECEIVED BY 2.
(Signature) (Time)
(Printed Name) (Date)
(Company)

RECEIVED BY (LABORATORY) 3.
(Signature) (Time)
(Printed Name)
(Company)

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Farmington, New Mexico 87401

CLIENT:	Geoscience Consultants	DATE REPORTED:	11/19/91
ID:	9110171545		
SITE:	MW-9	DATE RECEIVED:	10/21/91
LAB NO:	F7539	DATE COLLECTED:	10/17/91

Lab pH (s.u.)	7.34
Lab conductivity, umhos/cm	1640
Lab resistivity, ohm-m	6.11
Total dissolved solids (180), mg/L	1050
Total dissolved solids (calc), mg/L	923
Total alkalinity as CaC03, mg/L	556
Total hardness as CaC03, mg/L	737
Sodium adsorption ratio	0.92
Fluoride, mg/L	0.26
Nitrate, mg/L	<0.02
Nitrite, mg/L	<0.02

	mg/L	meq/L
Bicarbonate as HC03	677	11.1
Carbonate as C03	0	0
Chloride	219	6.18
Sulfate	9.06	0.19
Calcium	295	14.7
Magnesium	<0.1	<0.01
Potassium	8	0.2
Sodium	57.6	2.51
Major cations		17.4
Major anions		17.5
Cation/anion difference		0.12 %

Mary Stepp
Mary Stepp
Lab Director

Wanda Orso
Wanda Orso
Water Lab Supervisor

Inter·Mountain Laboratories, Inc.

2506 W. Main Street
Farmington, New Mexico 87401

CLIENT:	Geoscience Consultants	DATE REPORTED:	11/19/91
ID:	9110171700		
SITE:	MW-9A	DATE RECEIVED:	10/21/91
LAB NO:	F7540	DATE COLLECTED:	10/17/91

Lab pH (s.u.)........................	7.42
Lab conductivity, umhos/cm..........	1560
Lab resistivity, ohm-m.............	6.42
Total dissolved solids (180), mg/L..	1000
Total dissolved solids (calc), mg/L.	834
Total alkalinity as CaC03, mg/L.....	556
Total hardness as CaC03, mg/L.......	662
Sodium adsorption ratio............	0.90
Fluoride, mg/L......................	0.27
Nitrate, mg/L.......................	<0.02
Nitrite, mg/L.......................	<0.02

	mg/L	meq/L
Bicarbonate as HC03.......	677	11.1
Carbonate as C03..........	0	0
Chloride..................	165	4.66
Sulfate...................	10.7	0.22
Calcium...................	262	13.1
Magnesium.................	1.82	0.15
Potassium.................	7.5	0.19
Sodium....................	53	2.31
Major cations.........................		15.7
Major anions..........................		16
Cation/anion difference............		0.83 %

Mary Stepp
Mary Stepp
Lab Director

Wanda Orso
Wanda Orso
Water Lab Supervisor

Inter-Mountain Laboratories, Inc.

2506 W. Main Street
Farmington, New Mexico 87401

CLIENT:	Geoscience Consultants	DATE REPORTED:	11/19/91
ID:	9110170905		
SITE:	MW-11	DATE RECEIVED:	10/21/91
LAB NO:	F7541	DATE COLLECTED:	10/17/91

Lab pH (s.u.)	7.39
Lab conductivity, umhos/cm	1360
Lab resistivity, ohm-m	7.34
Total dissolved solids (180), mg/L	820
Total dissolved solids (calc), mg/L	727
Total alkalinity as CaC03, mg/L	462
Total hardness as CaC03, mg/L	376
Sodium adsorption ratio	2.97
Fluoride, mg/L	0.37
Nitrate, mg/L	<0.02
Nitrite, mg/L	<0.02

	mg/L	meq/L
Bicarbonate as HC03	564	9.24
Carbonate as C03	0	0
Chloride	138	3.9
Sulfate	28.8	0.6
Calcium	133	6.63
Magnesium	10.9	0.9
Potassium	7	0.18
Sodium	132	5.75
Major cations		13.5
Major anions		13.7
Cation/anion difference		1.02 %

Mary Stepp
Mary Stepp
Lab Director

Wanda Orso
Wanda Orso
Water Lab Supervisor

Inter·Mountain Laboratories, Inc.

2506 W. Main Street
Farmington, New Mexico 87401

CLIENT:	Geoscience Consultants	DATE REPORTED:	11/19/91
ID:	9110171100		
SITE:	MW-12	DATE RECEIVED:	10/21/91
LAB NO:	F7542	DATE COLLECTED:	10/17/91

Lab pH (s.u.)......................	7.75
Lab conductivity, umhos/cm..........	1200
Lab resistivity, ohm-m..............	8.32
Total dissolved solids (180), mg/L..	834
Total dissolved solids (calc), mg/L.	731
Total alkalinity as CaC03, mg/L.....	412
Total hardness as CaC03, mg/L.......	399
Sodium adsorption ratio.............	2.85
Fluoride, mg/L......................	0.48
Nitrate, mg/L.......................	0.04
Nitrite, mg/L.......................	<0.02

	mg/L	meq/L
Bicarbonate as HC03.......	503	8.24
Carbonate as C03..........	0	0
Chloride..................	170	4.79
Sulfate...................	21.4	0.45
Calcium...................	150	7.47
Magnesium.................	6.15	0.51
Potassium.................	6.4	0.16
Sodium....................	131	5.69
Major cations.....................		13.8
Major anions......................		13.5
Cation/anion difference...........		1.29 %

Mary Stepp
Mary Stepp
Lab Director

Wanda Orso
Wanda Orso
Water Lab Supervisor

Inter-Mountain Laboratories, Inc.

2506 W. Main Street
Farmington, New Mexico 87401

CLIENT:	Geoscience Consultants	DATE REPORTED:	11/19/91
ID:	9110171230		
SITE:	MW-13	DATE RECEIVED:	10/21/91
LAB NO:	F7543	DATE COLLECTED:	10/17/91

Lab pH (s.u.)	7.55
Lab conductivity, umhos/cm	1550
Lab resistivity, ohm-m	6.46
Total dissolved solids (180), mg/L	824
Total dissolved solids (calc), mg/L	836
Total alkalinity as CaC03, mg/L	499
Total hardness as CaC03, mg/L	477
Sodium adsorption ratio	2.73
Fluoride, mg/L	0.39
Nitrate, mg/L	0.07
Nitrite, mg/L	<0.02

	mg/L	meq/L
Bicarbonate as HC03	608	9.97
Carbonate as C03	0	0
Chloride	176	4.98
Sulfate	28.8	0.6
Calcium	181	9.02
Magnesium	6.38	0.53
Potassium	6.7	0.17
Sodium	137	5.97
Major cations		15.7
Major anions		15.6
Cation/anion difference		0.41 %

Mary Stepp
Mary Stepp
Lab Director

Wanda Orso
Wanda Orso
Water Lab Supervisor

Inter-Mountain Laboratories, Inc.

2506 W. Main Street
Farmington, New Mexico 87401

CLIENT:	Geoscience Consultants	DATE REPORTED:	11/19/91
ID:	9110171425		
SITE:	MW-14	DATE RECEIVED:	10/21/91
LAB NO:	F7544	DATE COLLECTED:	10/17/91

Lab pH (s.u.)........................	7.88
Lab conductivity, umhos/cm..........	1160
Lab resistivity, ohm-m..............	8.62
Total dissolved solids (180), mg/L..	846
Total dissolved solids (calc), mg/L.	739
Total alkalinity as CaC03, mg/L.....	548
Total hardness as CaC03, mg/L.......	592
Sodium adsorption ratio.............	0.81
Fluoride, mg/L......................	0.33
Nitrate, mg/L.......................	<0.02
Nitrite, mg/L.......................	<0.02

	mg/L	meq/L
Bicarbonate as HC03.......	671	11
Carbonate as C03..........	0	0
Chloride..................	109	3.07
Sulfate...................	16.5	0.34
Calcium...................	232	11.6
Magnesium.................	2.97	0.24
Potassium.................	4.7	0.12
Sodium....................	45.1	1.96
Major cations......................		13.9
Major anions.......................		14.4
Cation/anion difference............		1.58 %

Mary Stepp
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Lab Director

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Water Lab Supervisor

Inter-Mountain Laboratories, Inc.

2506 W. Main Street
Farmington, New Mexico 87401

CLIENT:	Geoscience Consultants	DATE REPORTED:	11/19/91
ID:	9110181300		
SITE:	MW-16	DATE RECEIVED:	10/21/91
LAB NO:	F7545	DATE COLLECTED:	10/18/91

Lab pH (s.u.)	7.69
Lab conductivity, umhos/cm	631
Lab resistivity, ohm-m	15.8
Total dissolved solids (180), mg/L	450
Total dissolved solids (calc), mg/L	310
Total alkalinity as CaC03, mg/L	141
Total hardness as CaC03, mg/L	232
Sodium adsorption ratio	0.56
Fluoride, mg/L	0.61
Nitrate, mg/L	2.88
Nitrite, mg/L	<0.02

	mg/L	meq/L
Bicarbonate as HC03	171	2.81
Carbonate as C03	0	0
Chloride	74	2.09
Sulfate	36.7	0.76
Calcium	92.7	4.63
Magnesium	0.11	0.01
Potassium	2.5	0.06
Sodium	19.7	0.86
Major cations		5.56
Major anions		5.87
Cation/anion difference		2.76 %

* Sample reanalyzed, no significant difference.

Mary Stepp
Mary Stepp
Lab Director

Wanda Orso
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Water Lab Supervisor

GCL **Geoscience Consultants, Ltd.**

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Las Cruces, NM 88004
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2615

Chain of Custody

DATE 10/18/91 PAGE 1 OF 1

LAB NAME InterMountain Laboratories
ADDRESS 2506 West Main Street
Farmington, NM 87401
TELEPHONE 505/326-4737

SAMPLERS (SIGNATURE)

ANALYSIS REQUEST

SAMPLE NUMBER	MATRIX	LOCATION	BASE/NEU/ACID CMPDS. GC/MS/ 625/8270	VOLATILE CMPDS. GC/MS/ 624/8240	PESTICIDES/PCB 608/8080	POLYNUCLEAR AROMATIC 610/8310	PHENOLS, SUB PHENOLS 604/8040	HALOGENATED VOLATILES 601/8010	AROMATIC VOLATILES 602/8020	TOTAL ORGANIC CARBON 415/9060	TOTAL ORGANIC HALIDES 9020	PETROLEUM HYDROCARBONS 418.1	TPH MODIFIED 8015	General Chem	PRIORITY POLLUTANT METALS (13)	CAM METALS (18) TTLC/STLC	EP TOX METALS (8)	SDWA-INORGANICS PRIMARY/SECONDARY	HAZARDOUS WASTE PROFILE	Cations/Anions			NUMBER OF CONTAINERS
9110171100	H2O	MW 12 DN																					
9110171230	"	MW 13																					
~~9110171240~~	~~"~~	~~Rinsate Blank~~																					
~~9110171245~~	~~"~~	~~Field Blank~~																					
9110171425	"	MW 4																					
9110171545	"	MW 9																					
9110171700	"	MW 9 A																					
9110170905	"	MW 11																					
9110181300	"	MW 16																					

PROJECT INFORMATION

PROJECT: PHILLIPS
PROJECT DIRECTOR M Nee
CHARGE CODE NO.
SHIPPING I.D. NO. 9223343835
VIA: Fed X

SAMPLE RECEIPT

TOTAL NO. OF CONTAINERS	
CHAIN OF CUSTODY SEALS	
REC'D GOOD CONDITION/COLD	
CONFORMS TO RECORD	
LAB NO.	

RELINQUISHED BY 1.	RELINQUISHED BY 2.	RELINQUISHED BY 3.
(Signature) [signature] (Time) 1700	(Signature) (Time)	(Signature) (Time)
(Printed Name) DAVID NEE (Date) 10/18	(Printed Name) (Date)	(Printed Name) (Date)
(Company) GCL	(Company)	(Company)

RECEIVED BY 1.	RECEIVED BY 2.	RECEIVED BY (LABORATORY) 3.
(Signature) Justin A Glass (Time) 2 PM	(Signature) (Time)	(Signature) (Time)
(Printed Name) Justin A Glass (Date) 10-21	(Printed Name) (Date)	(Printed Name)
(Company) IML	(Company)	(Company)

SPECIAL INSTRUCTIONS/COMMENTS:

no rinsate blank or field blank received

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